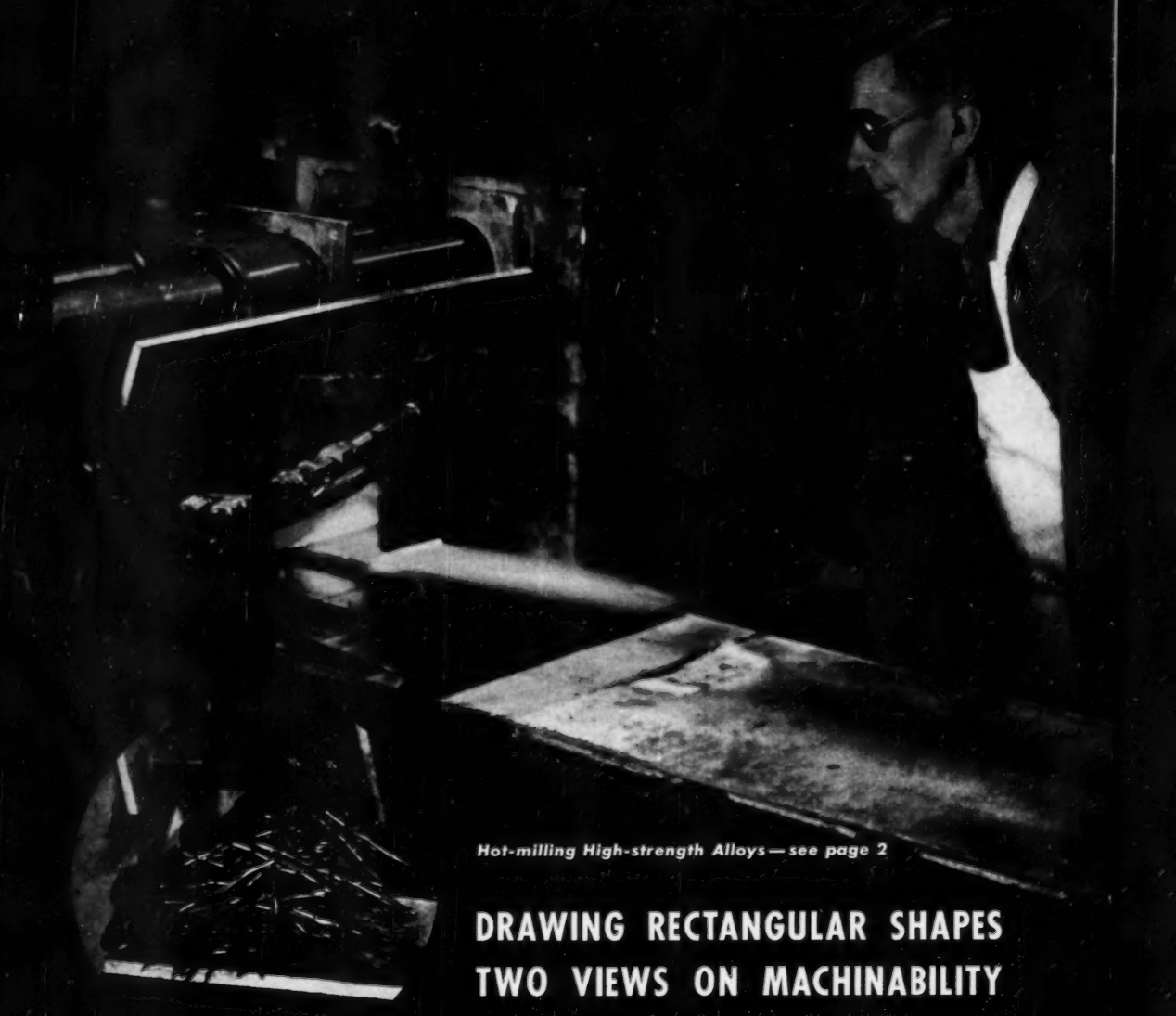
JULY 28, 1949

American Machinist

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION



Hot-milling High-strength Alloys—see page 2

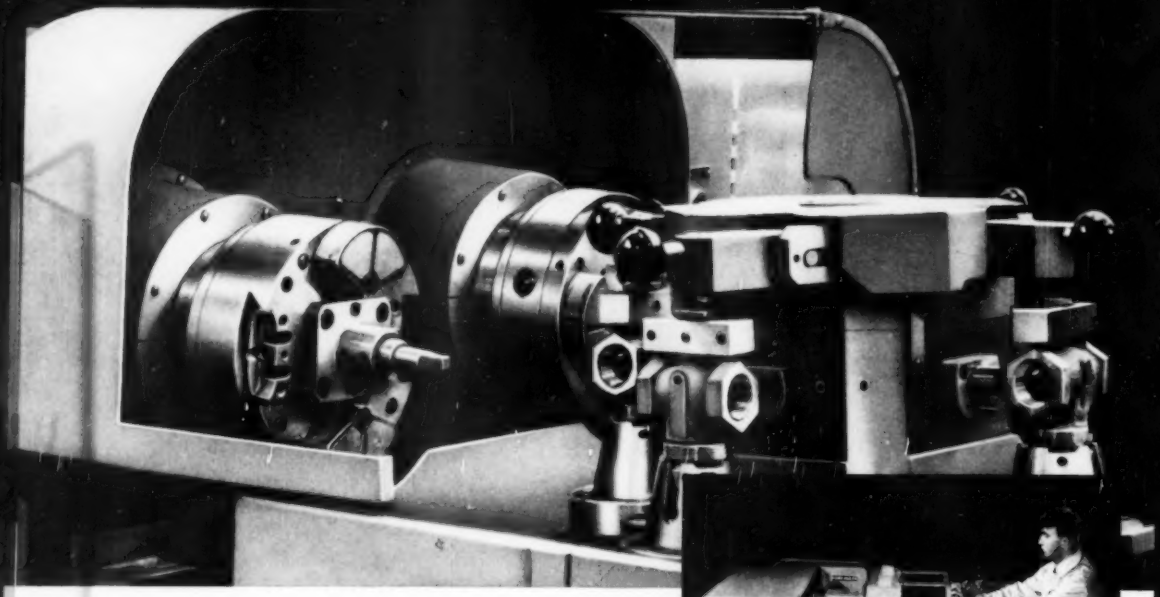
DRAWING RECTANGULAR SHAPES

TWO VIEWS ON MACHINABILITY

Valve Bodies Finished

THREE TIMES FASTER

on a New Heald Machine



This Heald Model 321 Bore-Matic is arranged for convenient end loading, and the rotary indexing fixture permits parts to be loaded and unloaded safely and easily while the machine is in operation.

...what's more, this Model 321 Bore-Matic is easier to operate, gives greater accuracy and produces a better finish

That's the actual production record reported by a large valve manufacturer. This new Heald Model 321 Bore-Matic is used to face off the inside valve seats of wedge-type valve bodies —an operation which requires a finished flat surface at precisely the correct angle. To accomplish this with maximum precision, the boringheads are mounted on an angle, as shown at the right, and the quills are equipped with cross-feed units for the facing operation.

The valve bodies are held in the specially-designed rotary type indexing fixture shown above, which permits much faster loading and unloading. This, together with the automatic cycle, faster table rapid traverse, and higher cutting speeds, made it possible to produce three times as many parts per hour as by previous methods.

No matter what your product, chances are Heald's specialists in precision finishing can help you make substantial savings like this in your plant, too. Your nearest Heald representative is always at your service.

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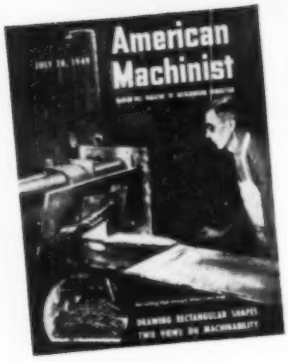


Chips and QUIPS

Our Cover . . . In *A.M.* for Feb. 10, J. B. Armitage and A. O. Schmidt of Kearney & Trecker discussed hardness as a machinability index. In one chart they showed that heated workpieces can be face-milled with higher feeds at lower horsepower. The experimental setup for doing the job is shown herewith in color—the large Kodachrome showing the heating equipment, the insert the character and color of chips. An oxyacetylene torch (Airco flat-surface, 3½ in. wide) was used to heat the work surface to 1000 to 1500 F, and working parts of the machine were shielded with asbestos. This put into the work about the same heat as is normally generated by the cutter, so no increase in cutter wear resulted, but feed rates could be eight times as great. Cutting speed was 236 sfpm.

Harold W. Francke took the Kodachromes.

Fingertip Sight . . . Several months ago, Assistant Editor Stocker began studying tools for the blind, ended up talking with a blind doctor at the American Foundation for the Blind who has developed many special tools for blind metalworking men. The story is in this issue. . . . Incidentally, Timken Roller Bearing, an early employer of blind workers, now has 34. Some are inspectors, gaging by sound rather than sight, others make the file test for hardness of rollers and races—still the best test Timken has developed. Blind workers wear red shop caps, so are easily distinguished.

Metal Spray . . . Our recent Special Report gave fundamentals on metal spraying—a process familiar to many for maintenance operations. But it frequently can be used too in production; for details see the article in this issue. The author, John Wakefield, wrote his first article for us about a year ago, says he has since written about 20 for other publications. We're getting to be like *The Saturday Evening Post* used to be—a discoverer of new authors. Want to be "discovered"?

Machinability . . . As materials become more complex, the ability to determine machinability becomes more important. Two views are presented in this issue, together for your convenience in studying the subject. One gives an equation for determining values; the other explains the subject in the light of latest developments.

Go or No-Go . . . If gages aren't accurate, they can tell more lies than a gypsy fortune-teller. To cut down the error quotient, we recommend you study the control system delineated in this issue. Far too frequently, parts which are exactly to gage are not exact parts—because the gage is no longer to gage.

Non-cooperative . . . Writes the drafting chief in the Plant Engrg. Dept. of a large electric company: "I have read 'How Material Handling Affects Plant Layout' (*A.M.*, Dec. 30, 1948) and I believe it is the finest article I have ever seen on this subject. In our plant there are about five departments that get this magazine, but unfortunately our office does not get it and these five departments will not let me have an issue as they keep them for reference purposes. Can you please provide me with a copy . . . ?" Shows how uncooperative a production man can be when he's got something he likes. We have the same problem with our personal file of *AM*. Somehow, one issue after another vanishes.

Drawing . . . Sergius D. Brootzkoos is well known in press circles as an authority. His latest contribution to knowledge are some pointers on drawing rectangular shapes. They have been assembled into our lead article.

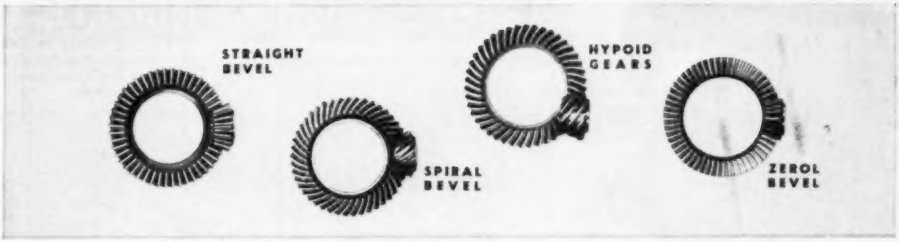
Carbides . . . In addition to our cover picture, carbides appear in our reference book sheets in this issue one RBS covering turret-lathe tools, another chip-breaker designs. . . . The third RBS, just to complete the record, and balance our content, gives some management data.

Carried Away . . . On occasion, somebody does such a thorough job on a subject that we can't keep our handling of it within bounds. This is true of J. A. Redmond's story on induction hardening of spur gears. We thought first of four pages, then went to six, eight, and finally and resignedly to twelve. There's so much information in it that you should have that we finally threw caution to the winds and made it a full-fledged Special Report. It's a difficult job to edit and to present, but we've done our best—subject to the whims of the engraver and the printing press, as always. Metallurgical photographs are always difficult to reproduce in print.

Coming . . . *A.M.* for Aug. 11 will have several articles to take your attention from the weather. There'll be an article on cast alloy tools, another on applying metallic coatings by evaporation, another giving pointers on shaving dies, still another on making miniature parts for meters. H. P. Bailey presents No. 7 in his series on portable tools. Our Special Report will be on buffing and polishing. There'll also be a description of broaching in a planer, something on seam-welding extinguishers, and a description of test jigs.

COMPLETE ENGINEERING SERVICE

ON YOUR BEVEL GEAR PROBLEMS



As builders of bevel gear machinery for the manufacture of straight bevel, spiral bevel, Zerol bevel or hypoid gears, we offer our services to you . . . in designing . . . in estimating production time and costs . . . in recommending the best equipment most suited to your requirements.

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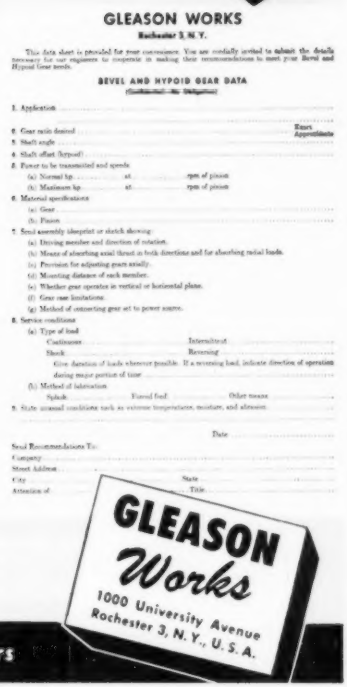
ESTIMATES OF YOUR PRODUCTION TIME AND COSTS,



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Rochester 3, N.Y.

This data sheet is provided for your convenience. You are cordially invited to submit the details necessary for our engineers to cooperate in making their recommendations to meet your Bevel and Hypoid Gear needs.

BEVEL AND HYPOID GEAR DATA

(Confidential—No Obligation)

1. Application .....
2. Gear ratio desired ..... Exact Approximate
3. Shaft angle .....
4. Shaft offset (hypoid) .....
5. Power to be transmitted and speeds
   (a) Normal hp. ..... at ..... rpm of pinion
   (b) Maximum hp. ..... at ..... rpm of pinion
6. Material specifications
   (a) Gear .....
   (b) Pinion .....
7. Send assembly blueprint or sketch showing:
   (a) Driving member and direction of rotation.
   (b) Means of absorbing axial thrust in both directions and for absorbing radial loads.
   (c) Provision for adjusting gears axially.
   (d) Mounting distance of each member.
   (e) Whether gear operates in vertical or horizontal plane.
   (f) Gear case limitations.
   (g) Method of connecting gear set to power source.
8. Service conditions
   (a) Type of load
   Continuous ..... Intermittent .....
   Shock ..... Reversing .....
   Give duration of loads wherever possible. If a reversing load, indicate direction of operation during major portion of time .....
   (b) Method of lubrication
   Splash ..... Forced feed ..... Other means .....
9. State unusual conditions such as extreme temperature, moisture, and abrasion .....

Date .....

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City ..... State .....
Attention of ..... Title .....

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WHAT WE NEED to help you

For design engineering: (1) Preliminary layouts or prints of proposed bevel gear drive designs, (2) Type of drive, (3) Horsepower and speed required, (4) Type of loading (constant, intermittent or shock), and (5) Driving member and direction of rotation.

For production engineering: (1) Blueprints of your bevel gear designs, (2) Material specifications and manufacturing tolerances, (3) Quantity of gears to be produced per month, and (4) Number of working hours per month available for gear production.

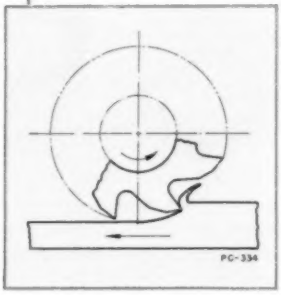
Builders of Bevel Gear Machinery for Over Eighty Years

For those who want to cut up

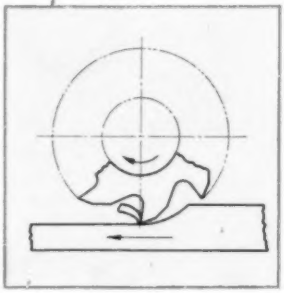
. . AND CUT DOWN TOO!

CINCINNATI No. 5 Plain Dual Power Dial Type. Ask for these catalogs: High Power Dial Type—M-1644. Dual Power Dial Type—M-1647.

Conventional, or up-milling cut. You know all about this, so just skip to the next drawing.



Down-milling cut. You'll find this of value in two cases: 1) thin parts, difficult to clamp; 2) where breakout of metal at the end of the cut cannot be tolerated. CINCINNATI High Power and Dual Power Dial Types handle operations like these.



Backlash is bad for table feed screws of milling machines, for it's tough on down-milling operations. With the realization that down-milling is sometimes highly desirable, Cincinnati Milling Engineers developed several automatic backlash eliminating devices, one type of which is incorporated in CINCINNATI High Power and Dual Power Dial Type Milling Machines.

> Through the action of two independent nuts on the table feed screw, a crown gear, meshing with teeth on the two nuts, tends to rotate them in opposite directions. Thus the backlash is entirely eliminated, and down-milling as well as up-milling operations may be assigned to these machines.

This is but one of the many standard features of value in CINCINNATI High Power and Dual Power Dial Types. Others . . . Dynapoise overarm, automatic table feed cycles. Additional features are outlined in attractive literature. It's yours for the asking.

THE CINCINNATI MILLING MACHINE CO.

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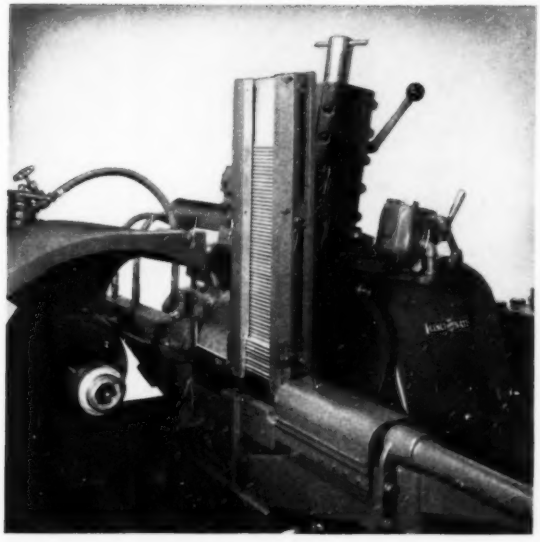
MILLING MACHINES • BROACHING MACHINES • CUTTER SHARPENING MACHINES
FLAME HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

Going Down...

PRECISION GRINDING COSTS

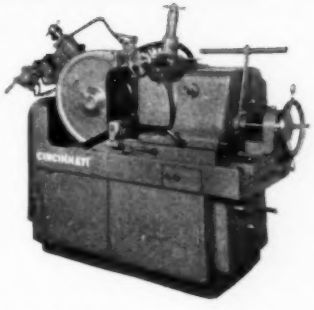
ON LOWER LEVEL



Precision grinding costs always go down when Cincinnati Application Engineers take over. In this example, they have developed equipment for automatically grinding armature shafts at a high rate of production. A hydraulically operated magazine type loading fixture automatically lowers the parts to work rest height. Positioning, grinding to size, and ejecting is accomplished with a hydraulic automatic infeed attachment, synchronized with a work positioning and ejecting device. Both wheels are equipped with a new type of precision profile truing device having antifriction bearing slides.

Close-up of loading device, mounted on CINCINNATI FILMATIC No. 2 Centerless, developed by Cincinnati Application Engineers to grind the entire length of armature shafts. The grinding wheel has been removed to show the equipment to better advantage.

FILMATIC



Right: CINCINNATI FILMATIC No. 2 Centerless Grinding Machine. Complete details may be obtained by writing for catalog G-591.

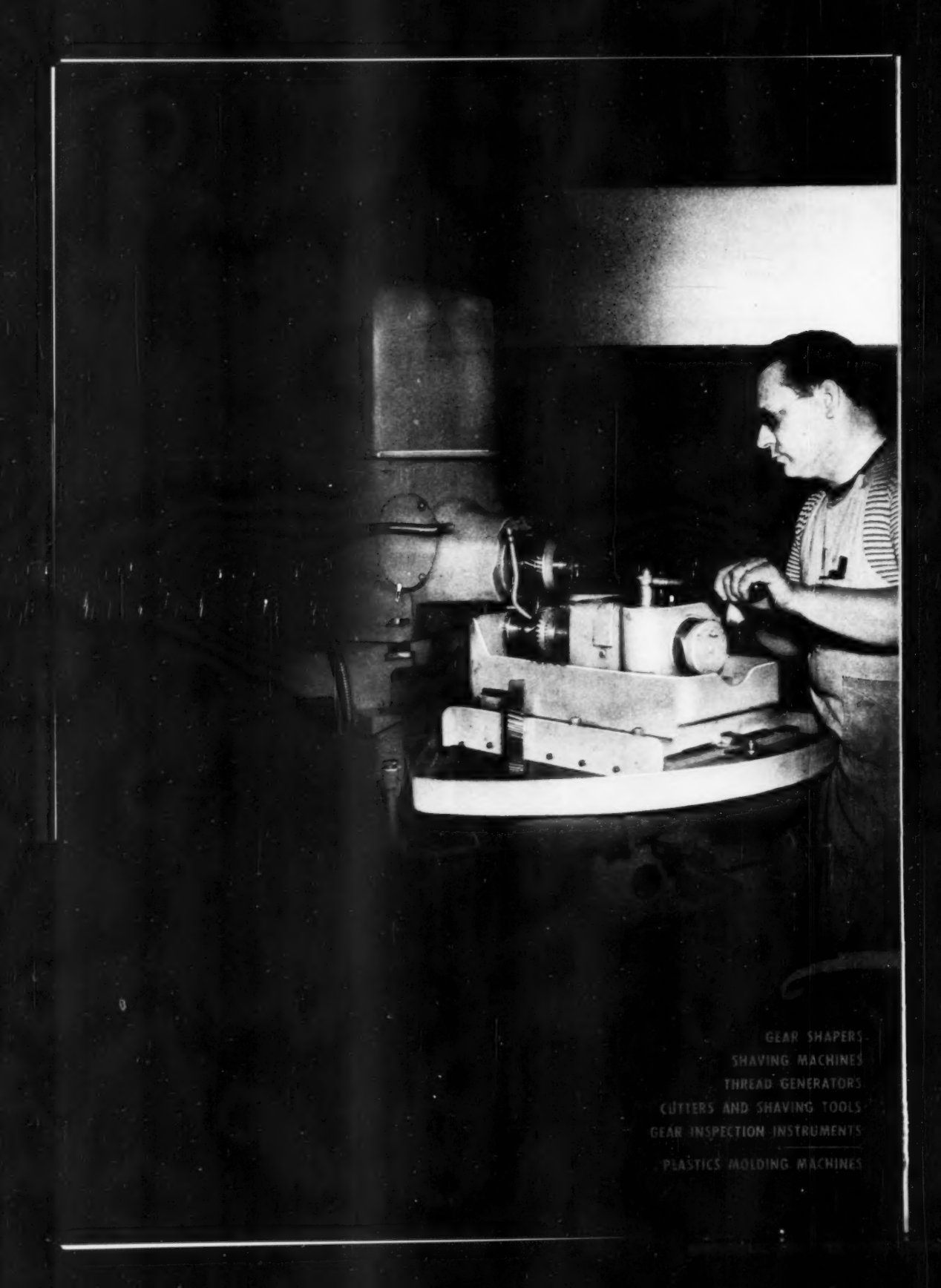
CINCINNATI APPLICATION ENGINEERS want a chance to show you what can be done to reduce the cost of your precision grinding operations. Send us a resumé of your problems, or ask for one of our fieldmen to visit you.

CINCINNATI

CINCINNATI GRINDERS INCORPORATED

CINCINNATI 9, OHIO, U. S. A.

CENTER TYPE GRINDING MACHINES • CENTERLESS LAPPING MACHINES • CENTERLESS GRINDING MACHINES



GEAR SHAPERS
SHAVING MACHINES
THREAD GENERATORS
CUTTERS AND SHAVING TOOLS
GEAR INSPECTION INSTRUMENTS

PLASTICS MOLDING MACHINES

'FULL-TOOL' SHAVING Sets a Pace...

Shaving as a finishing process now assumes an important role in low-cost mass production. In the Fellows 'Full-Tool' method you have a finishing process that more than doubles output. The unique manner of tool application provides a shorter stroke with freer cutting at higher reciprocating speeds. Cutting action is so distributed as to obtain an even finer finish with less wear on the shaving tool. The production-minded manufacturer will want to know more of the facts and figures on this new method of low-cost finishing. Write our nearest office.

'FULL-TOOL' SHAVED IN 23 SECONDS!

'FULL-TOOL' SHAVED IN 30 SECONDS!

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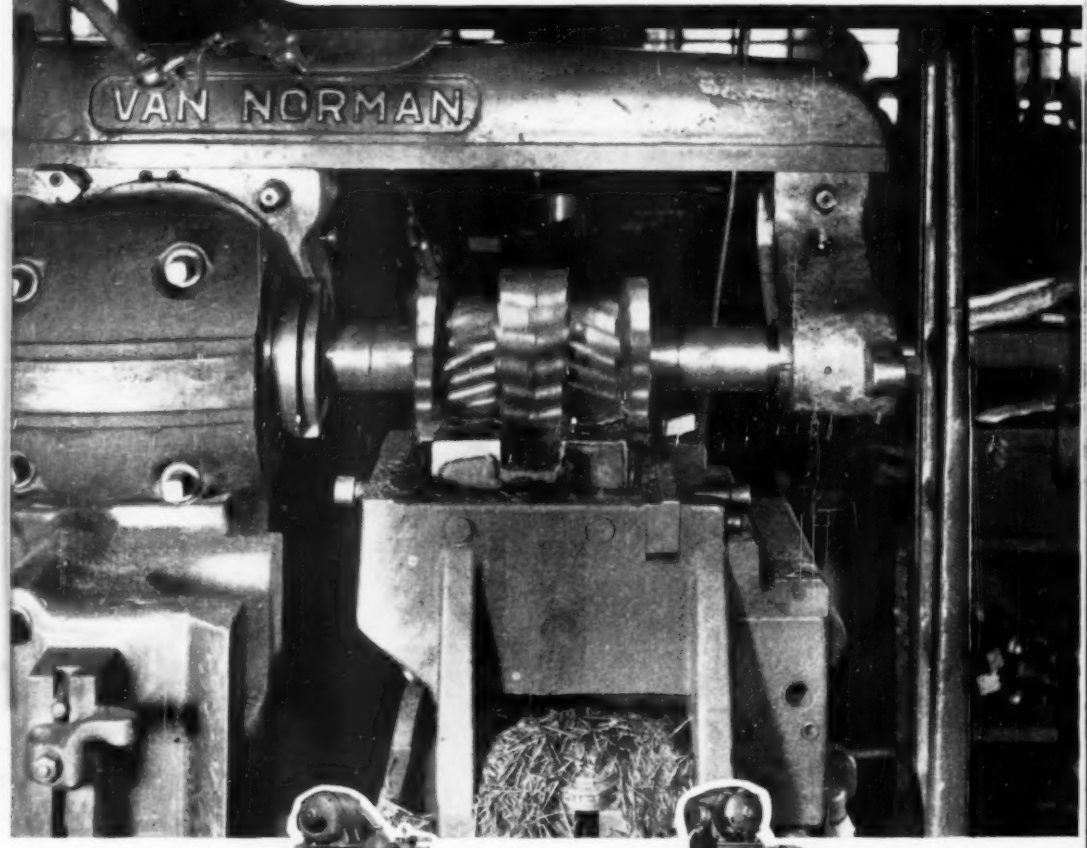
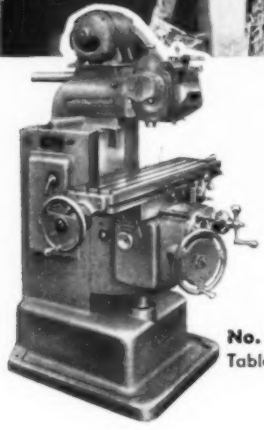




No. 16
Table: 37″ x 9½″

No. 22L
Table: 45″ x 10″

Ram Type Millers

Increase Productivity Wherever They Are Used

Whether it be in the toolroom, production department, machine shop or laboratory, Van Norman Ram Type Millers increase milling output and cut cost.

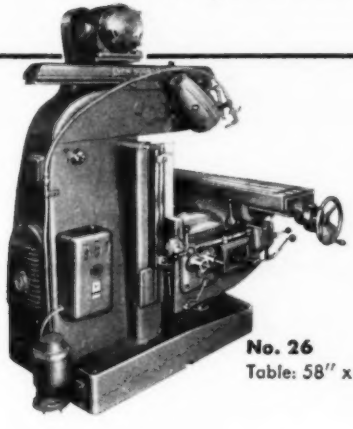
Here's how these versatile milling machines enable you to perform horizontal, vertical and angular milling on *one* machine. Simply position the adjustable cutterhead in the required position, lock and you are ready to proceed with the work. They minimize down time for work reset-ups because most jobs can be carried through to completion in the original set-up. In addition, the adjustable cutterhead in combination with the moveable ram and saddle cross feed increases the work range of these millers. Ease of operation is assured with the conveniently grouped operating controls, large easy-to-read dials and quick change speed and feed selectors.

Van Norman Ram Type Millers are available in a wide range of sizes with plain and universal saddles to meet practically all milling requirements. Write for information.

VAN NORMAN COMPANY

SPRINGFIELD 7, MASSACHUSETTS

"It pays to Van Normanize"



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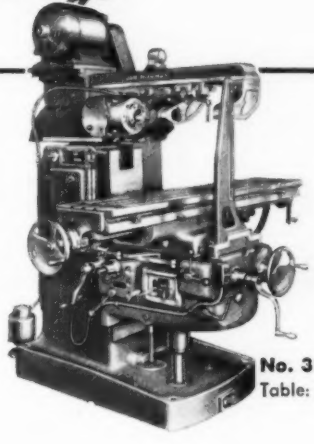

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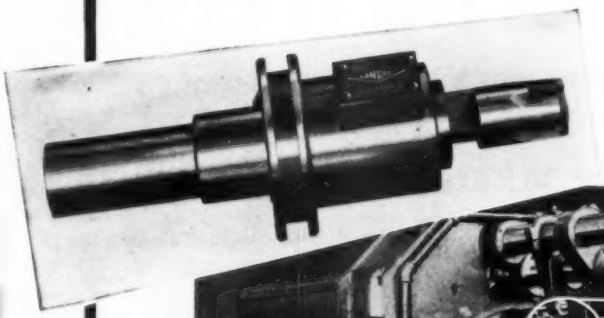
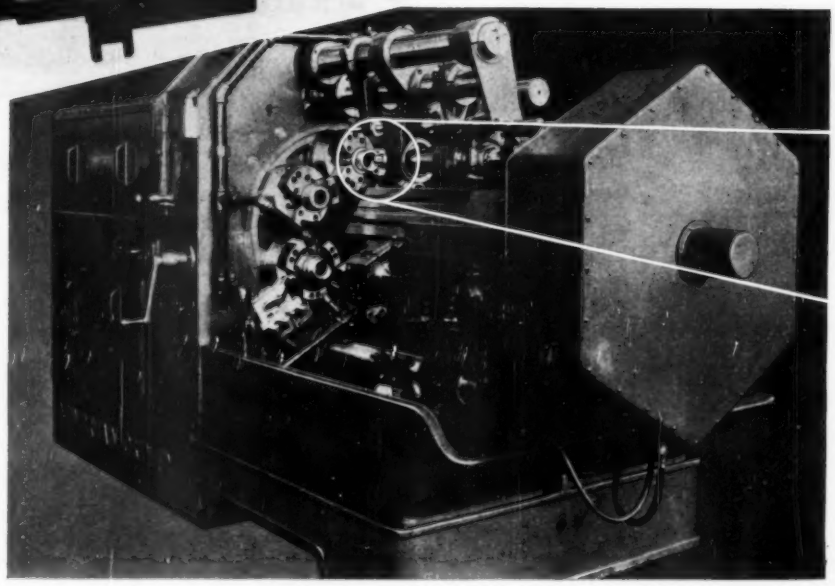
AN IMPROVED

Cuts Internal





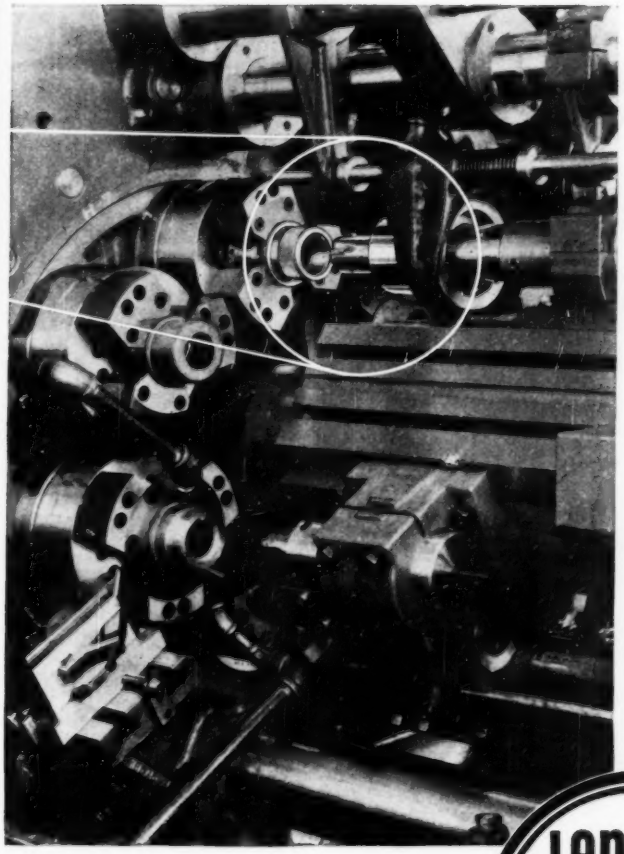
● The LL Taps are designed primarily for tapping tapered threads to A. P. I. standards. An outstanding feature is the detachable tap head permitting the use of various size tap heads to cover a wide range of thread sizes with a minimum amount of equipment.

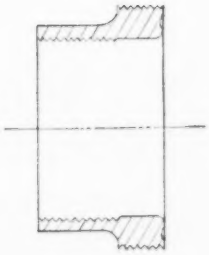
● In the improved Style ALM Heads, where an even number of chasers is used, no two chasers are directly opposite each other. This adds greater rigidity for the tap and permits the use of greater radial clearance, giving a freer cutting action with resulting increased chaser life. The Style LL Tap Body is made in four sizes to cover a range of nominal pipe sizes from 1" to 12", inclusive.

THE WORLD'S LARGEST MANUFACTURER OF

Landis TAP

Tapered Threads at 30 ft. per min.





• Using the new Landis Style LL Receding Chaser Collapsible Tap on an automatic screw machine, 2" 11½ pitch tapered pipe threads 1-5/16" long are tapped in quick change unions for oil field use at the rate of 30 feet per minute. The unions are cold worked forging 2⅜" in diameter of 185-220 Brinell hardness. The same piece is also made of malleable iron, and tapered threads are tapped at the rate of 120 feet per minute.

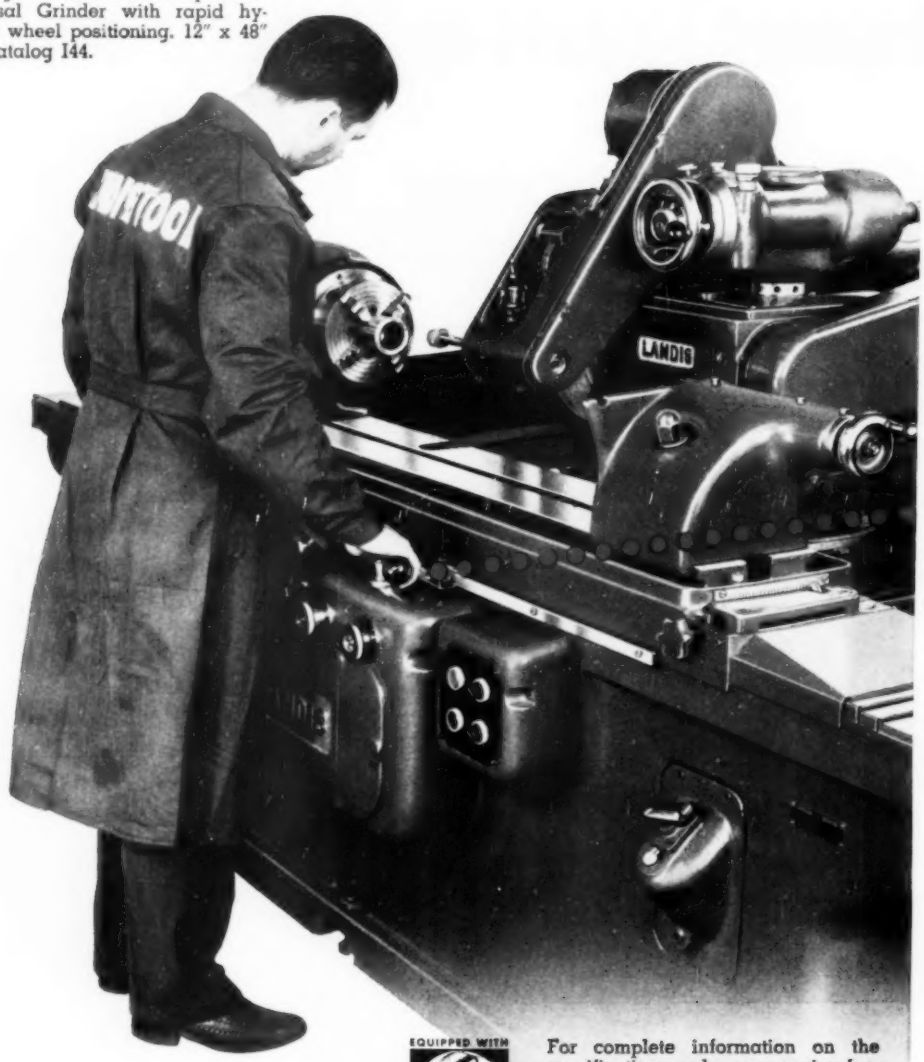
Write for Bulletin G-95

THREADING EQUIPMENT

LANDIS Machine COMPANY
WAYNESBORO PA., U.S.A.

A NEW SETUP TIME SAVER

Operator setting up for internal grinding. LANDIS TOOL Hydraulic Universal Grinder with rapid hydraulic wheel positioning. 12" x 48" LCH Catalog 144.



LANDIS TOOL
Precision Grinders

EQUIPPED WITH MICROSPHERE BEARINGS

For complete information on the specifications and money saving features of LANDIS TOOL Precision Grinders, refer to our section in Sweet's Catalog File or write for our new condensed catalog.

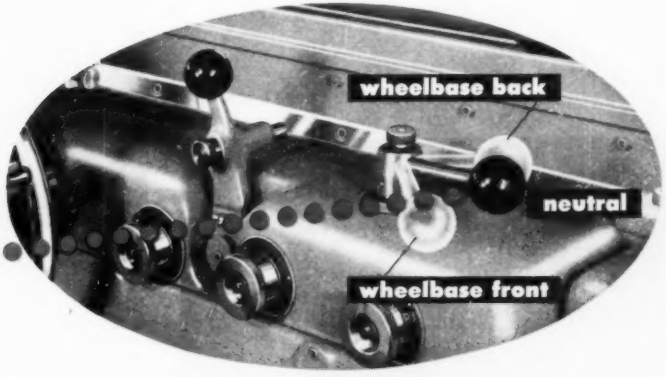
105

ON LANDIS TOOL UNIVERSALS

rapid hydraulic wheel positioning

1. Gives big savings where setups are frequent
2. Wheel positioning time cut 50% or more
3. Reduces operator fatigue

you move a lever



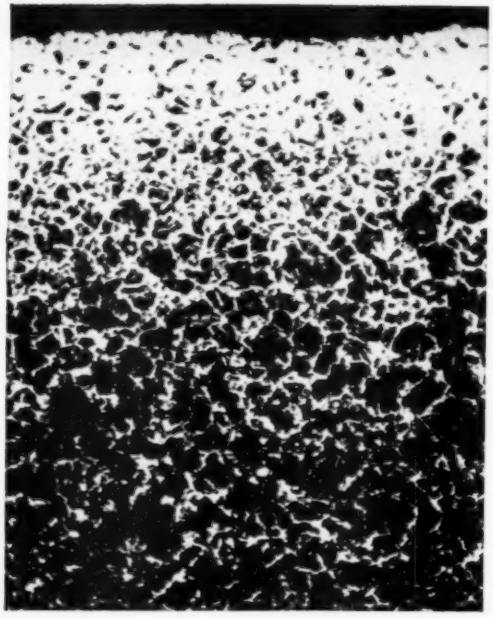
instead of positioning by hand

features of LANDIS TOOL Hydraulic Universal Grinders

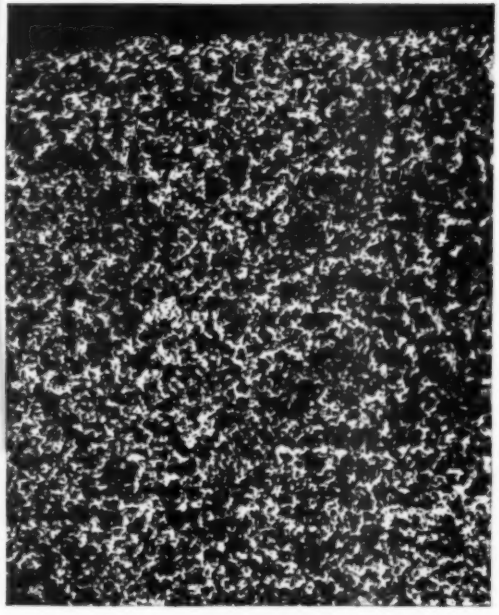
1. MICROSPHERE WHEEL SPINDLE BEARINGS
2. EYE LEVEL WHEEL FEED
3. HYDRAULIC OPERATION
4. VARIABLE SPEED HEADSTOCK
5. RAPID HYDRAULIC WHEEL POSITIONING
6. SWINGING INTERNAL FIXTURE

LANDIS TOOL COMPANY / WAYNESBORO, PENNA.

Stop



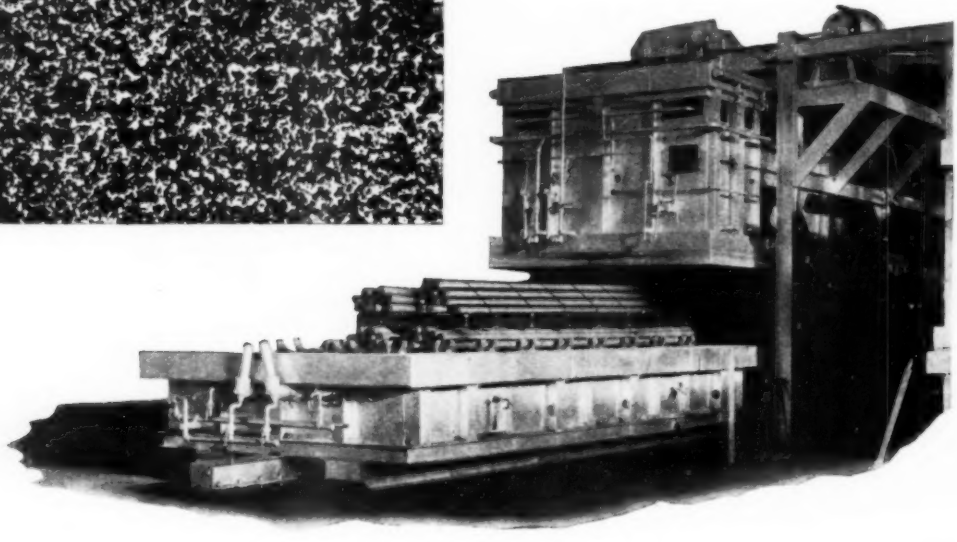
At Right: Photomicrograph showing "decarb" to a depth of .020" in the surface of a hot rolled bar of C-1050 steel—magnified 100 times.



At Left: Photomicrograph showing the same bar after carbon correction annealing. Note restoration of carbon on the surface and also the refinement of grain structure.

* * *

Below: One of the radiant-tube, prepared-atmosphere furnaces in which bars are carbon correction annealed.



"Decarb" waste

with Republic Union Cold Drawn CARBON CORRECTED BARS

Metal and money both are wasted when you must machine or grind away the surface of steel bars headed for heat treat. Buying bars oversize to allow for surface removal is another costly practice once made necessary by surface decarburization.

Now, however, "decarb" no longer need complicate your production. Republic Union Cold Drawn Carbon Corrected Bars stop "decarb" waste. They permit you to cut unit production costs of steel parts, heat treated to produce a high surface hardness around a tough core . . . particularly those parts which are hardened by induction heating.

Carbon correction is an annealing treatment in a prepared atmosphere. It restores carbon, lost by decarburization during hot rolling, to the surface of the bars before cold drawing. The costs of removing "decarb"—which in a steel like C-1050 often means removal of 20 thousandths of an inch, or more—thereby are saved.

Because carbon correction includes annealing, steels such as C-1050 and C-1151, which frequently are used for parts requiring high surface hardness, also are improved substantially in

MACHINABILITY.

Cost-cutting, product-improving MACHINABILITY always is identified with Republic Union Cold Drawn Steels—Bessemer screw stock, carburizing grades or stainless steels. For almost 60 years, it has been the tradition in Union Drawn mills and laboratories that MACHINABILITY comes *first*. Today, Union Drawn metallurgists and engineers are ready to help you use Carbon Corrected and other Republic Union Cold Drawn Bars to best advantage. Write for full information specifically applied to your production.

REPUBLIC STEEL CORPORATION
Union Drawn Steel Division • Massillon, Ohio
GENERAL OFFICES • • • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, New York

Republic

REPUBLIC STEEL

UNION COLD DRAWN STEELS

Free-Machining Bessemer, Alloy and Enduro Stainless Steels
•
Union Cold Drawn Special Sections
•
Union Cold Drawn and Ground Rounds; Turned and Polished Rounds; and Turned, Ground and Polished Rounds (Union Precision Shafting.)

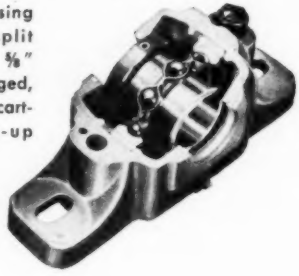
LINK-BELT offers the "QUALITY QUINTET" in BALL AND ROLLER BEARINGS

Series 200 ball bearings

Solid or split housing pillow blocks (solid shown) for shafts 5/8" to 3 15/16"—also flanged, take-up, and hanger blocks.

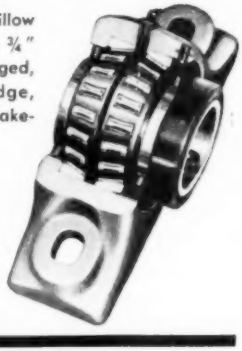
Series 300 ball bearings

Solid or split housing pillow blocks (split shown) for shafts 5/8" to 3 15/16". Also flanged, flanged cartridge, cartridge and take-up blocks.



Series 400 roller bearings

Solid housing pillow blocks for shafts 3/4" to 4"—also flanged, flanged cartridge, cartridge and take-up blocks.



Series 6800-6900 roller bearings

Split housing pillow blocks with adapter sleeves for mounting on commercial shafting of 1 7/16" to 6 15/16" diameter.

Split housing pillow blocks for press-fit on precision-turned shafting of 1.7700" to 7.4800" diameter.

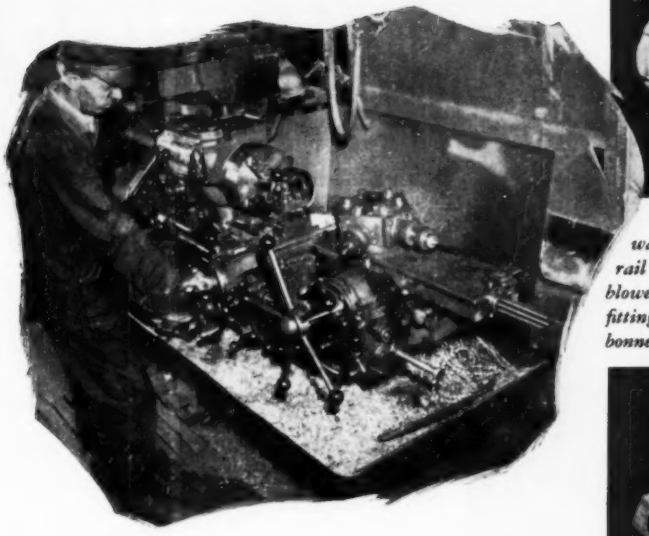
Series 7800-7900 roller bearings

SEND FOR CATALOGS!

LINK-BELT COMPANY

Indianapolis 6, Chicago 9, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Distributors in Principal Cities. 11.485

LINK-BELT BALL AND ROLLER BEARINGS



"I do over 125 *different* jobs a year on my Warner & Swasey"

They turn out a lot of work at the Nickel Plate shops in Lima, Ohio. Like all railroad shops, the problem lies in machining a wide variety of work in lots ranging from a single piece up to large volume. Some days no two jobs are alike; that calls for highly flexible machine tools.

All jobs shown at the right are done on the Warner & Swasey No. 3 Universal Turret Lathe with thread cutting lead screw attachment, shown above. In fact, over 125 different jobs a year are machined on this one turret lathe.

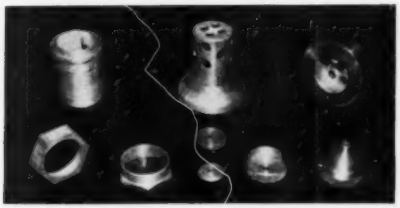
For fast change-over from job to job, the Nickel Plate uses the Universal Tooling Setup. Down time for setup has been cut to a minimum. Hadn't you better investigate Warner & Swasey's cost cutting efficiency?

You can machine it better, faster, for less... with a Warner & Swasey

WARNER & SWASEY
Machine Tools
Cleveland

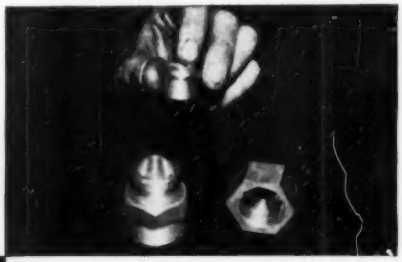
TURRET LATHES • MULTIPLE & SINGLE SPINDLE AUTOMATICS
PRECISION TAPPING AND THREADING MACHINES

From left to right, front to back: rail washer connection; water check drain plug; rail washer connection; patch bolt; round house blower connection; water glass gauge plug; pipe fitting spanner nut; whistle valve; boiler check bonnet and packing nut.



Front row: six parts of fire extinguisher. Back row: injecture pipe fitting spud; blow-off of cock strainer joint ring.

Brazing collars, joint ring; booster bearing bolt; choke plugs and steam gauge cock nut.



Parts for water gauge tank packing: packing nut; packing gland and connection.

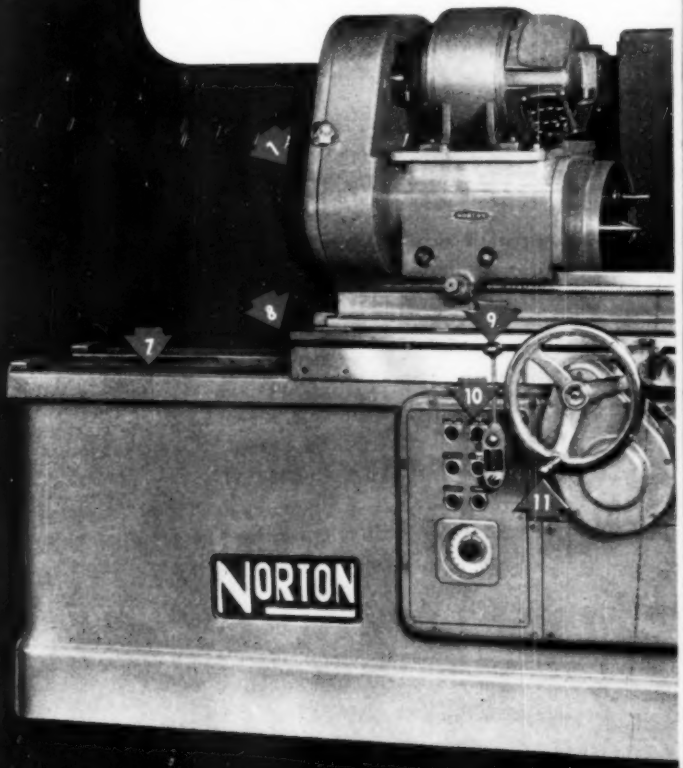
Look at these COST-CUTTING

New NORTON Type CTU

1. Close-Approach Rear Base Design
2. Stand-Up Electrical Controls Mounting
3. Swing-Back Wheel Guard Cover
4. Mist-Control Hinged Hood
5. Easy-Swing Nozzle Mount
6. The Famous NORTON Wheel Spindle Unit
7. Space-Saver Ribbon Type Base Way Guards
8. Quick-Clean Coolant Ramp
9. Feather-Touch Work Jogging Lever
10. Finger-Tip Automatic or Manual Work Rotation Selector
11. Silky-Sure Hand Table Traverse
12. Quick-Action Pre-Set Truing and Grinding Speed Control
13. Either-End Table Dwell Control
14. No-Search "Click-Count" Wheel Feed Mechanism
15. "One-Lever" Grinding Cycle Control for Semi-automatics
16. Instant-Action Automatic Feed Rate Controls
17. Knee-High Hydraulic and Lubricating Pump Mounting

...Compare Them With

HERE are 17 of the reasons why you'll like the new Norton line of 6" and 10" cylindrical grinders—17 features that give new ease of operation and new ease of maintenance.

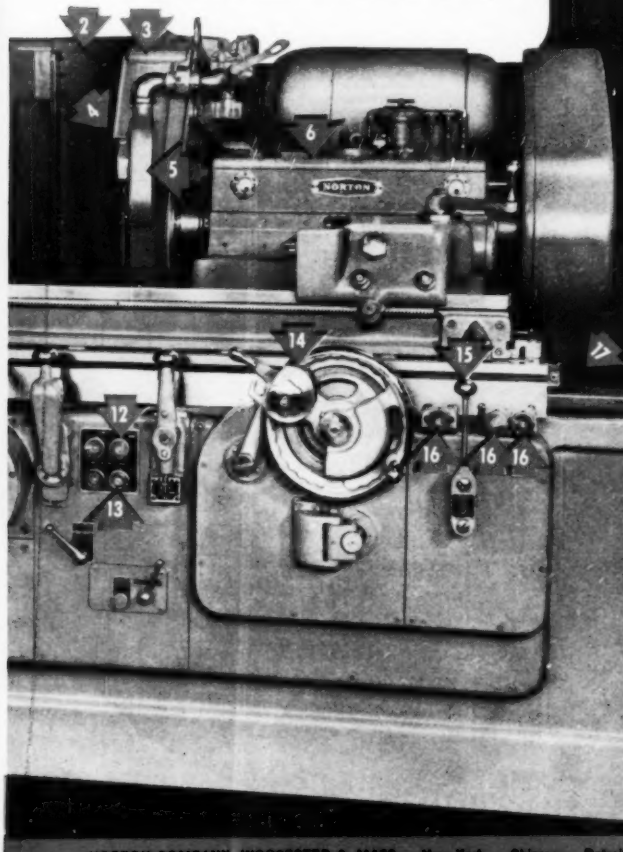


Abrasives · Grinding Wheels · Grinding and Lapping Machines · Refractories · Porous Mediums · Non-slip Floors · Metallic Products · Labeling Machines

FEATURES of the Cylindrical Grinders

Your Present Equipment

Compare these features with your present equipment. You will see how new efficiencies can be achieved with Norton CTU's that will give you the lower grinding costs so essential today.



NEW FEATURES NEW CATALOGS

The outstanding features of these new Norton Grinders are graphically illustrated and described in a new series of catalogs. Write for any or all—no obligation.

Catalog 157-2—Norton 6" Type CTU Cylindrical Grinders

Catalog 1488-1—Norton 6" Type CTU Semiautomatic Cylindrical Grinders

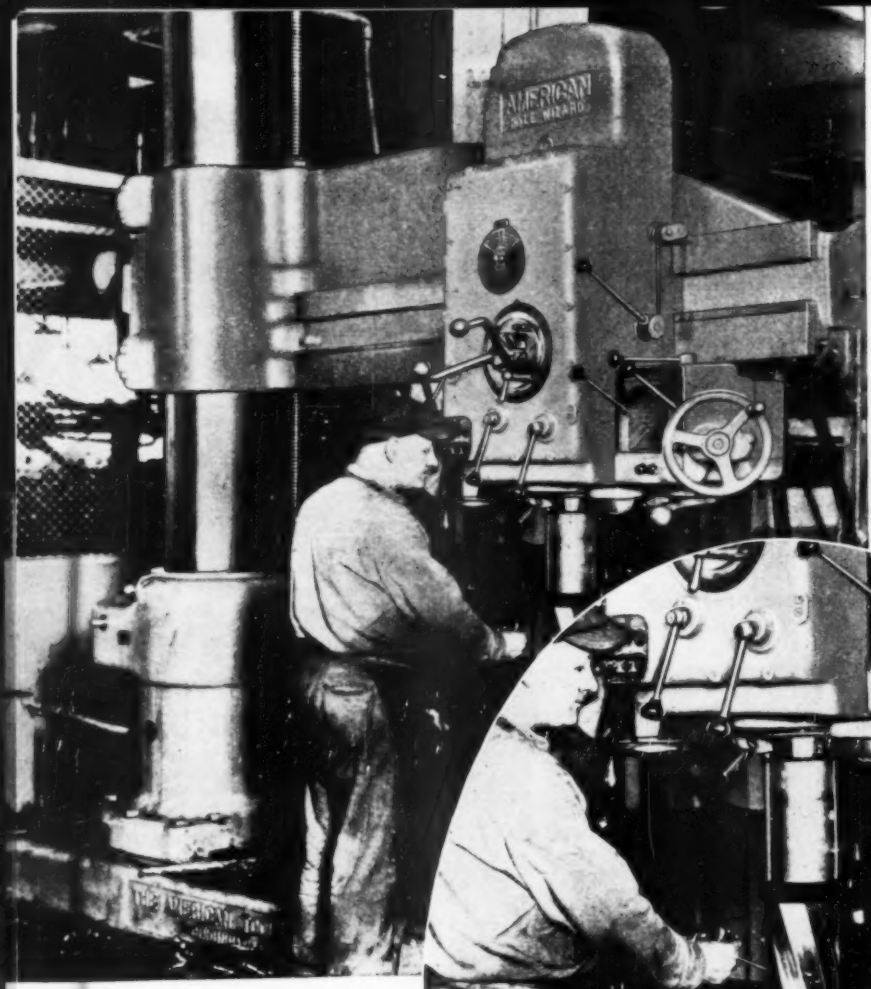
Catalog 166-2—Norton 10" Type CTU Cylindrical Grinders

Catalog 1787-1—Norton 10" Type CTU Semiautomatic Cylindrical Grinders

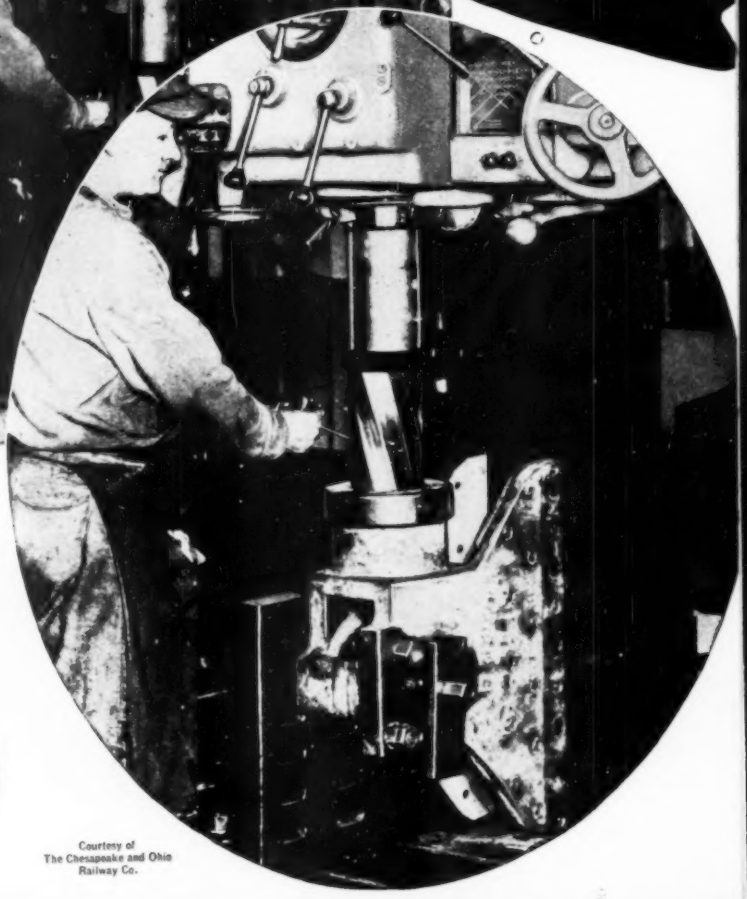
NORTON GRINDERS and LAPPERS

M-578

NORTON COMPANY, WORCESTER 6, MASS. - New York - Chicago - Detroit - Cleveland - Hartford - Distributors in All Principal Cities



The



Taper reaming locomotive cross heads for piston rod fits.

Courtesy of
The Chesapeake and Ohio
Railway Co.

THE AMERICAN TOOL WORKS CO.

Acid Test of SPINDLE CONSTRUCTION

Reaming cross heads for piston rod fits is about the toughest job you can find for a radial drill spindle.

This work must be done at slow speeds, without chatter and with a fine finish.

IT'S A TOUGH ONE BUT--

1 **The boring mill construction of the "American" Hole Wizard Spindle does the job. Its 100% anti-friction design with adjustment for wear insures frictionless operation and maintenance of original accuracy.**

2 **The patented Double Lo-Hung Spindle Drive locates the large diameter driving gear at the bottom of the head close to the work, thus minimizing spindle torque.**

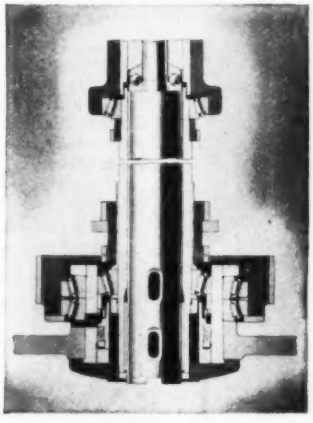
3 **The large diameter spindle, recently increased to add 37% to its rigidity, easily resists the enormous torsional effort imposed by this job.**

4 **Spindle shake is reduced to an absolute minimum by allowing only .00025" freedom between the ground nitrided spindle and the honed nitrided spindle sleeve. This is especially valuable on accurate boring operations.**

These four spindle characteristics are YOUR assurance that YOUR tough ones will be done easier, quicker and cheaper with an "American" Hole Wizard on the job.

Civilian goods and services must be produced in greater quantities and at lower costs. The "American" Hole Wizard Radial definitely is a contributor to this cause.

Patented Double Lo-Hung Spindle Drive.



Patented Double Lo-Hung anti-friction spindle mounting.

BULLETIN 327 TELLS THE STORY . . . YOURS FOR THE ASKING

Lathes and Radial Drills **Cincinnati, Ohio U.S.A.**

Job File No. 1949

MALLEABLE NUT PRODUCTION

Fully Automatic

CONTROLLED BY T-J CYLINDERS

All moving parts are controlled hydraulically by T-J Cylinders —on this Malleable Nut Production Machine designed and built by Roy Hays & Associates, Rockford, Ill., for the Wagner Malleable Products Co., Decatur, Ill.

It's *fully automatic*—the operator only places nuts in stations. Nine T-J Cylinders, 40 ton to ½ ton, help complete the job of cutting off sprue, sizing, boring, facing, chamfering and threading 2,500-¾ std. pipe thread nuts per hour.

For your tough jobs of power movement —pushing, pulling or lifting—*save labor, speed production* and *cut costs* with T-J Air and Hydraulic Cylinders! Many standard sizes and styles . . . both cushioned and non-cushioned types . . . 100 lb. or 50,000 lb. Precision-built for long-life dependability. Write for latest catalogs. The Tomkins-Johnson Co., Jackson, Michigan.

FOR POWER MOVEMENT IN ANY DIRECTION

100 LB. or 50,000 LB.

32 YEARS EXPERIENCE

T-J

TOMKINS-JOHNSON

RIVETORS . . AIR AND HYDRAULIC CYLINDERS . . CUTTERS . . CLINCHORS

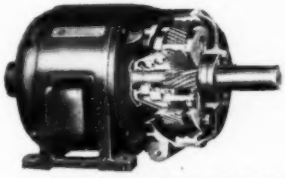
Buy TRI-CLAD Gear Motors

REG. U.S. PAT. OFF.

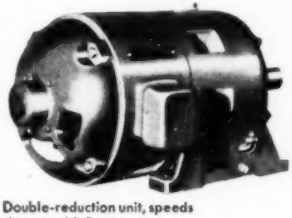
when? . . . . . NOW!

how? . . . FROM STOCK!

9 strategic locations throughout the country assure you of Fast Delivery



Single-reduction unit, speeds down to 155 rpm.



Double-reduction unit, speeds down to 13.5 rpm.

Most popular Tri-Clad gear-motor ratings, from 1 to 15 hp, are available right off warehouse shelves.

Look at what you get—the industry proved Tri-Clad induction motor for low-speed drives. Extra load carrying capacity in a smaller space than conventional gears because General Electric's planetary gear system gives you an additional 1:1 ratio of reduction. You get easier mounting in a smaller space, more motor protection with Tri-Clad gear-motors.

You'll find that standard G-E gear-motors fill the bill for most low-speed drives. Where special requirements must be met, G-E engineers can build you a gear-motor engineered to your specifications.

Call your nearest General Electric sales office—or General Electric Distributor now for FAST SERVICE on all your gear-motor requirements. ***Apparatus Dept., General Electric Company, Schenectady 5, N. Y.***

GENERAL ELECTRIC

WINTER

"BALANCED ACTION" TAPS

Winter Brothers now offer you the newest development in taps: "Balanced Action"—for uniform and accurate tapping. *Balanced Action* is an exclusive Winter development and applies to the complete Winter line of chip driver, hand, machine screw, nut, pipe, pulley, and stove bolt taps. It is made possible by new technical advances in Winter manufacture, giving highly accurate flute spacings, flute contours, chip driver contours, and chamfers. The result is better size control and longer tool life. A complete description of this new advance in tap design and manufacture is given in the new booklet, "Now—Balanced Action." Write for your free copy.

ALWAYS AT YOUR SERVICE

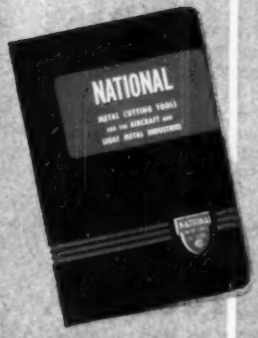
YOUR LOCAL DISTRIBUTOR carries a complete stock of WINTER Taps on his shelves—as close to your tapping problems as the telephone on your desk.

WINTER BROTHERS COMPANY • Division of the National Twist Drill and Tool Company

Rochester, Michigan, U. S. A. Distributors in Principal Cities • Branches in New York, Detroit, Chicago, San Francisco

FOR HEAVY WORK IN LIGHT METALS . . .

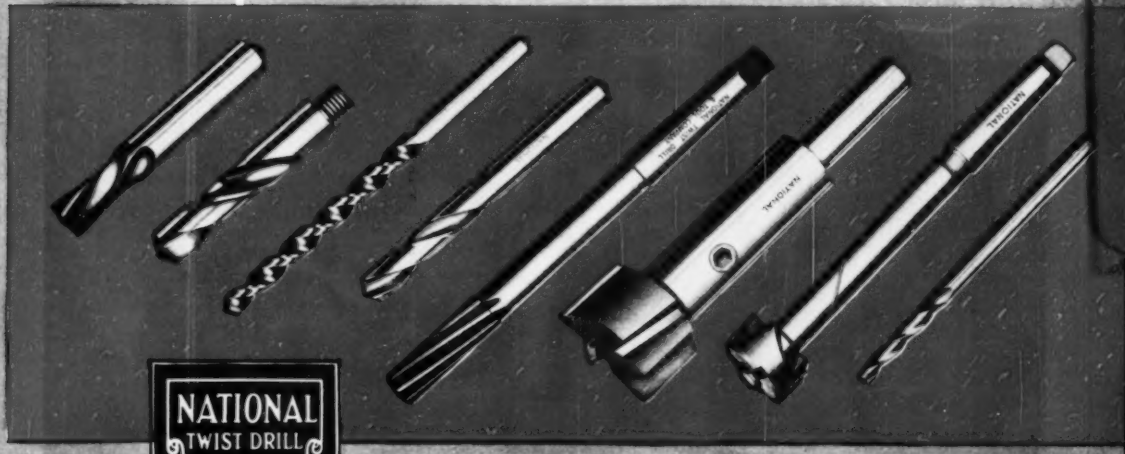
NATIONAL CUTTING TOOLS



National's complete line of rotary metal cutting tools includes many of special usefulness to the aircraft and other light metal industries. Typical are the router bit, threaded shank drill, twist drills, chucking reamer, counterbore, and inverted spotfacer shown below. Designs feature highly polished flutes to reduce friction and high helix angles to facilitate chip ejection. All are of extra sturdy construction. National's light metal tools are fully described in a new catalog supplement, "National Metal Cutting Tools for the Aircraft and Light Metal Industries." A copy is yours on request.

CALL YOUR DISTRIBUTOR

LEADING DISTRIBUTORS EVERYWHERE offer complete stocks of NATIONAL metal cutting tools. Call them for cutting tools or any other staple industrial product.



NATIONAL TWIST DRILL & TOOL CO. ROCHESTER MICH. U.S.A.

National

NATIONAL TWIST DRILL AND TOOL COMPANY • Rochester, Michigan, U.S.A.

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ARMSTRONG
TOOL HOLDERS...
for the toughest steels!

The "Armstrong System" provides special ARMSTRONG TOOL HOLDERS for ARMALOY (cast alloy) and for ARMIDE (carbide-tipped) cutters. With these modern cutting tools, the toughest and hardest steels are easily machined. Far heavier feeds and the extremely high cutting speeds become practical (300 f.p.m. with ARMALOY cutters; 600 f.p.m. with ARMIDE cutters). Delays for tool re-grinding are reduced to an absolute minimum—edges hold up to 100 times as long.

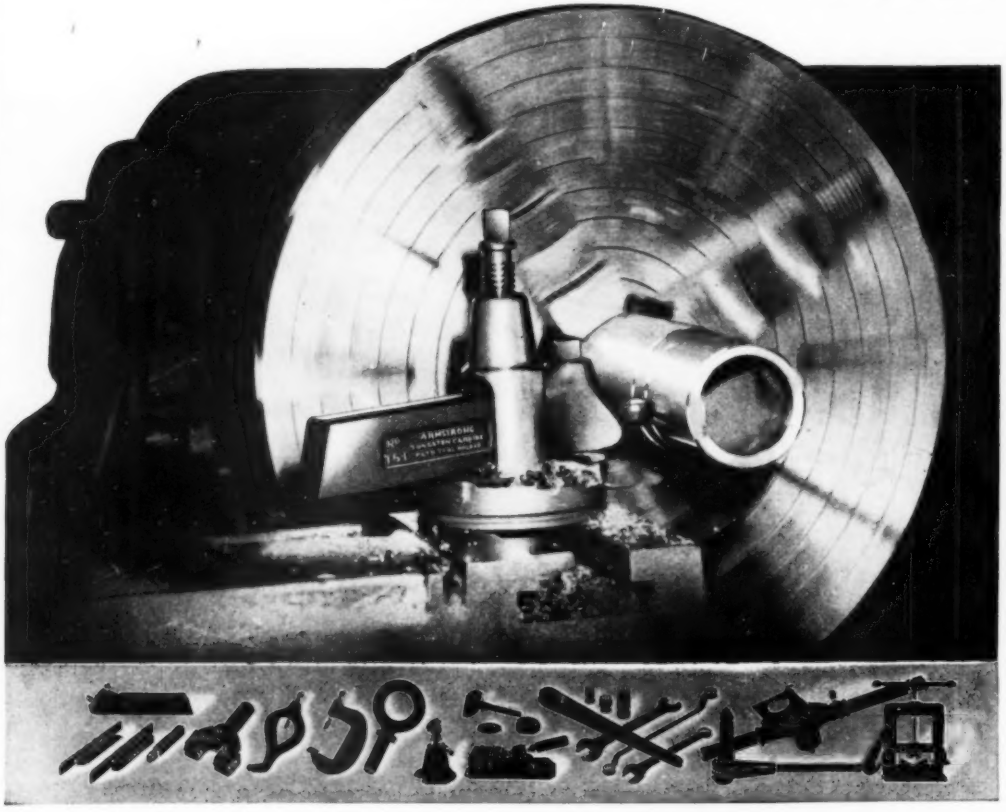
These new tool holders and cutters are stocked by your Local ARMSTRONG industrial distributors.

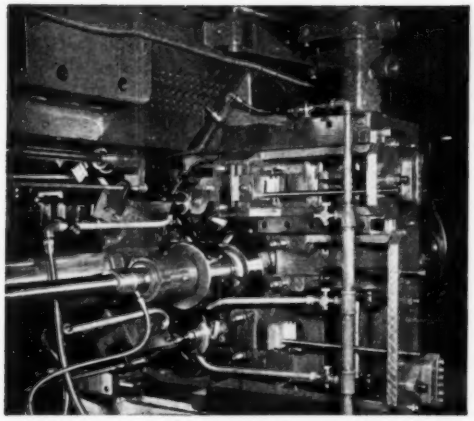
WRITE FOR CATALOG

ARMSTRONG BROS. TOOL CO.

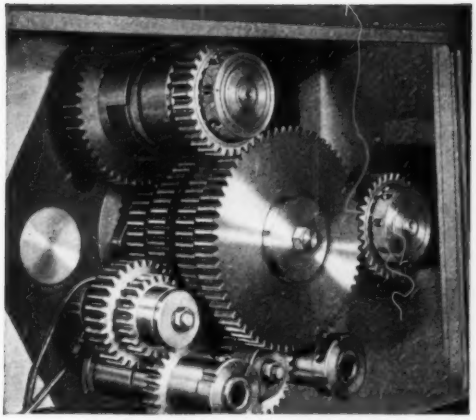
"The Tool Holder People"

5215 West Armstrong Ave. **Chicago 30, U.S.A.**





Full Swing for Main and Auxiliary End Slide Standard and Special Tool Mountings



Cone "Full-Choice" Open End Attachment Drive

IS HALF A LOAF BETTER THAN ONE ?

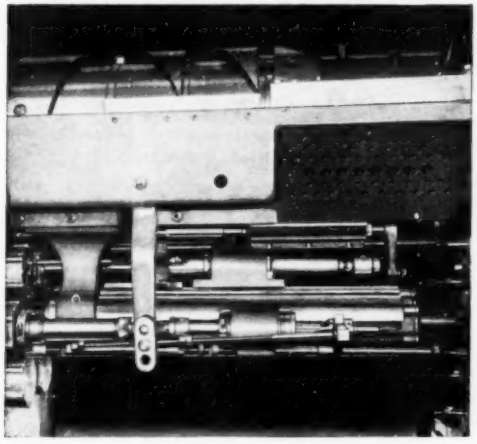
Machine capacity can usually be measured by tooling accommodation. The facility available to handle the job will determine a machine's dollar value.

Lack of a "full choice" accommodation of tooling positions for endworking tools and attachments can be a costly handicap to a multiple spindle automatic. The inability to swing to full collet capacity die heads, hollow mills, trepans, and internal necking tools, can limit a machine's usefulness on many jobs from zero up. Like half a loaf — better than none, but much less than one.

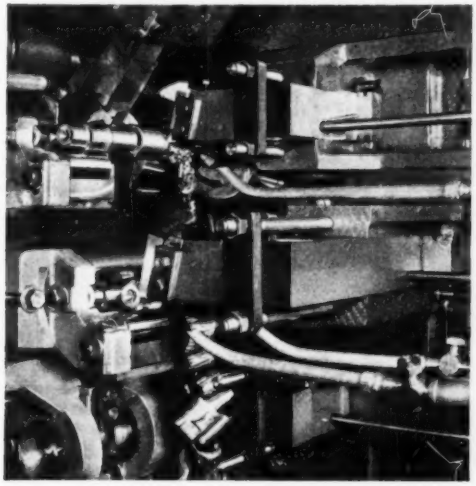
The "full choice" tooling accommodation of Conomatic cross slides, main end slides, auxiliary end slides and endworking attachment drive positions, are worth checking.

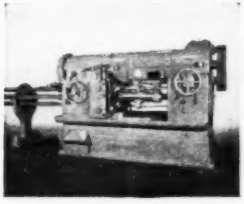
Write to Cone for Buyer's Chart which lists overall requirements of Multiple Spindle Automatics.

"All-Position" End Attachment Mounting



Standard Forming Slide and Auxiliary Cross Slide Facility





A comparison with ALL Automatics will lead you to

#6

Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC.
WINDSOR, VT., U.S.A.

WHY three-

The new General Electric three-phase frequency changer welding control has definite advantages for many users of resistance welders. Below are some of the questions we are frequently asked about it.

Q. I'm planning to install more machines, and my distribution lines are heavily loaded. Should I consider three-phase control?

A. Yes, because it has low kva demand, plus many other advantages. However, it may be more economical to solve your power supply problem another way—we'll be glad to help you.

Q. Can three-phase control be used for different types of welding?

A. It is used for spot, seam, projection, and gun welders, although we do not generally recommend it for the latter because it is usually economically unjustified.

Q. Where is it particularly useful?

A. In welding aluminum. There is little tip pick up and consequently not much electrode cleaning required with three-phase control.

Q. What is the difference between this system and the conventional single-phase system?

A. Basically, the method of producing a weld is the same in both. However, by converting three-phase to single-phase, low-frequency power, there is less reactance and lower kva demand. The bulletin gives more details. Now let's check the advantages shown at right.

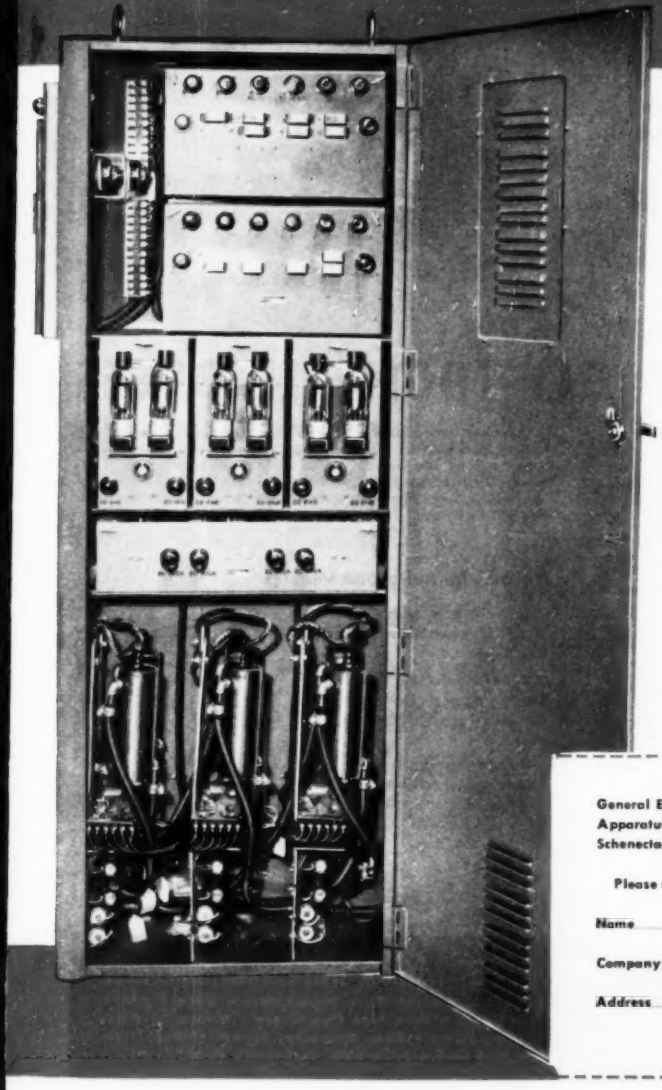
Have you seen

"This Is Resistance Welding"

General Electric's MORE POWER TO AMERICA full-color movie? Clearly describes and explains various types of welding—contains tips for improving production with this process. Ask your welding distributor or the nearest G-E office for a showing.

GENERAL ELECTRIC

phase control for resistance welders?



ADVANTAGES OF G-E THREE-PHASE WELDING CONTROL

1. high power factor
2. three-phase, essentially balanced load
3. low kva demand
4. only one, compact cabinet, machine mounted
5. special features for easy servicing
6. electronic heat control
7. electronic weld timing—dial setting
8. for seam, spot, or projection welders

COME TO GENERAL ELECTRIC

for information, for service, for equipment. You'll get unbiased answers to your questions about control for resistance welding . . . about the welding control for *your* installation. Write today for Bulletin GEC-491 on the *new* G-E three-phase control.

General Electric Company
Apparatus Department, Section H 645-49
Schenectady 5, New York

Please send me a copy of GEC-491 on three-phase welding control.

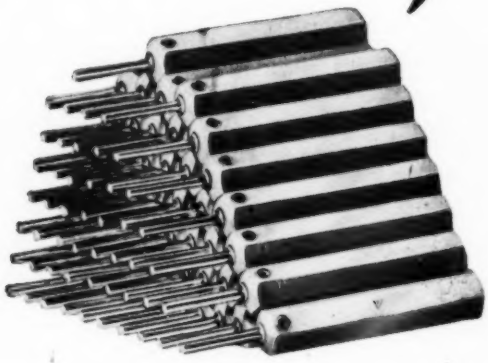
Name .....

Company .....

Address .....

Van Keuren

CARBOLOY
Wire Type
PLUG GAGES
are the right answer



1 VK CARBOLOY=50 TOOLSTEEL GAGES

After considerable experimentation with various wear resistant materials, we have chosen Carboloy as being the most practical, durable and economical. Carboloy does not flake or chip easily and is quite suitable for wire type plug gages as small as .020" in diameter.

Wire Type Plug Gages were originated by the Van Keuren Co. in 1925 and are now recognized as the most economical gages for measuring small holes. The original wire type plug gages were made of tool steel—High Speed steel doubled gage life. VK Chromium Plate gave 5 times the life, and VK Carboloy 50 times the life of tool steel gaging units. All of these materials are still in use and have their particular applications.

VK Carboloy gaging units are made in sizes from .020" to .500" diameter. They are made only in the wire type design because this is by far the most economical plug gage. In cases where it is desired to use VK Carboloy wire type Go units with existing No Go taper insert units, special handles can be furnished for this purpose.

Van Keuren Wire Type Plug Gages assure longer lasting precision and lower gage cost, because the entire 2" length of gage can be used. When the end of the wire becomes worn, it is ground off. The wire type unit is securely held in the unit by a split bushing and a headless set screw.

VK Carboloy Wire Type Plug Gages are made to Class B accuracy, plus .00005" minus, .00000" on the Go unit and plus or minus .000025" on the No Go unit. Closer or wider tolerances can be supplied if desired.

On your next order Specify VK Wire Type Plug Gages: VK Carboloy for long runs because of the enormous saving in gage cost; VK Carboloy for fussy jobs because of the infinitesimal gage wear and insurance that the parts will be within the specified limits; VK Tool Steel—High Speed Steel—Precision Chromium for less exacting jobs. You will be assured of the best in accuracy, quality and delivery.

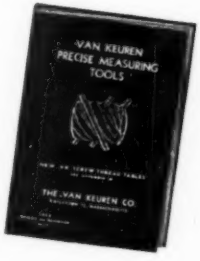
CATALOG AND HANDBOOK No. 34

This 208 page volume represents 2 years of research sponsored by the Van Keuren Co.

It presents for the first time in history a simple and exact method of measuring screws and worms with wires.

It tells how to measure gears, splines and involute serrations. It is an accepted reference book for measuring problems and methods.

Copies free upon request.



THE Van Keuren CO., 173 WALTHAM STREET, WATERTOWN, MASS.

30th YEAR

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Plug Gages • Carboloy Measuring Wires

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

Announcing...

THE COMPLETE LINE OF

Oil Tite CONTROL STATIONS AND UNITS

Control-Engineered

The *new* line of Westinghouse Stations and Units is Control-Engineered—engineered, designed and built to give you features that can improve an entire control operation. Check them over . . . see how they apply to *your* system.

POSITIVE SEAL—Lifetime resilient gasket provides a never-failing seal against oil, coolant, cutting compound and water.

UNIT FLEXIBILITY—Any combination of Oil-Tite Units can be used in these stations.

SIMPLIFIED WIRING—Flexible leads from box to cover are eliminated. Unique design permits mounting contact blocks in base of enclosure.

MOVABLE OPERATORS—Can be rotated 90° or 180°, allowing station mounting in any convenient position. Nameplate can be attached to any side.

ADAPTABLE COVER—Can be used as an attractive flush plate for machine cavity. Operators and contact blocks are then mounted on the cover, making a self-contained unit.

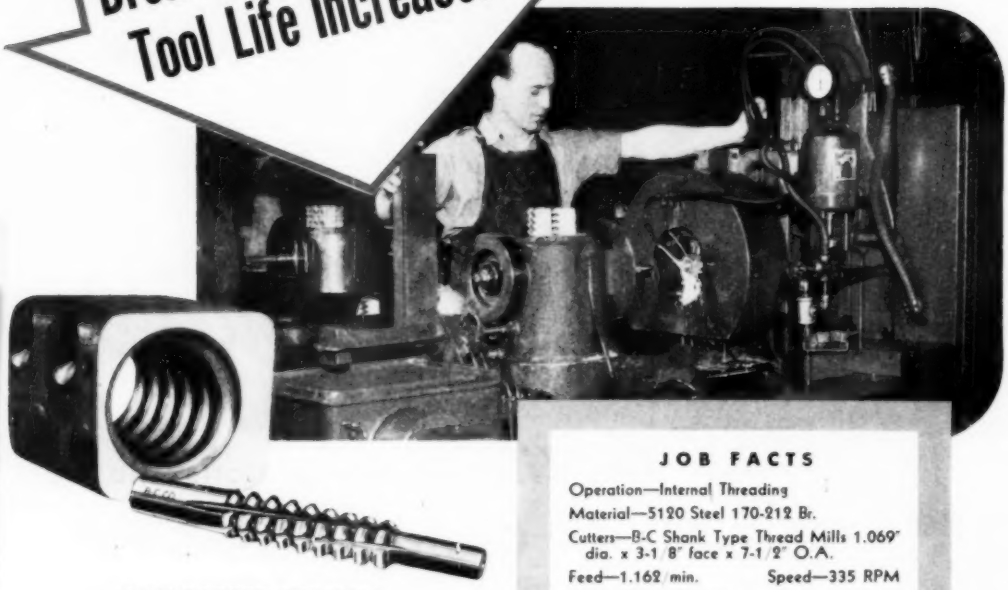
Westinghouse Control Stations and Units can be applied to all types of heavy-duty, pilot control circuits and controllers. If you are expanding or improving your system, there's a place for Westinghouse Control Stations and Units. Get complete information from your near-by Westinghouse office, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-30003

Westinghouse

Oil Tite

CONTROL STATIONS

Breakage Eliminated! Tool Life Increased!



With BARBER-COLMAN
JOB-ENGINEERED FORM CUTTERS

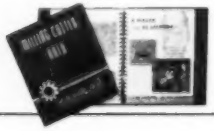
JOB FACTS

Operation—Internal Threading
Material—5120 Steel 170-212 Br.
Cutters—B-C Shank Type Thread Mills 1.069" dia. x 3-1/8" face x 7-1/2" O.A.
Feed—1.162/min. Speed—335 RPM
Cutting Time—.56 min.
Tool Life—350 pcs./sharp.
10,500 pcs./cutter

More production with less tool cost is the record on this job. Small diameter internal threads with special form require a tool with a long cutting face, capable of removing a large amount of metal at high speed. The heavy chip load causes vibration which, on conventional type unsupported thread cutters, results in frequent breakage and poor tool life.

Barber-Colman cutter engineers designed a special tool with extra clearances and an outboard pilot support to steady the cutting action. Now cutting time has been reduced to .56 minutes per piece and tool life has reached the remarkable level of 10,500 pieces per cutter.

Cutting tools built to fit the specifications of the job always pay off in lower tool costs and lower production costs. That's why we'd like to show you what Barber-Colman Job-Engineered Cutters will do on your next job.

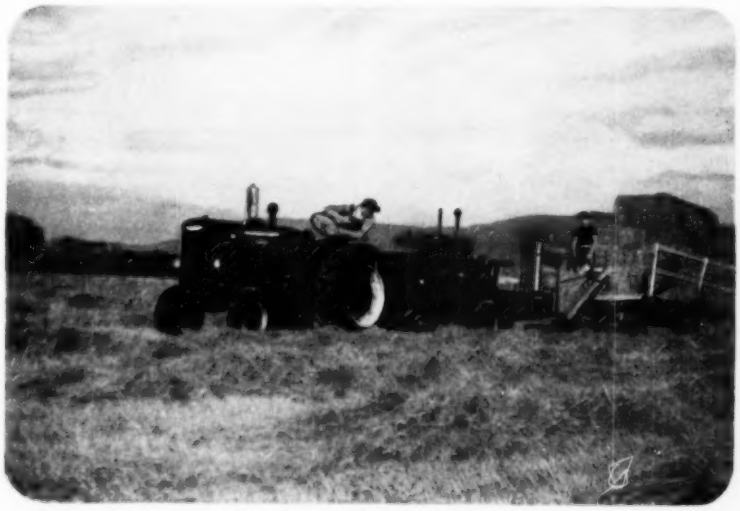


METHODS ENGINEERS!
Get this file of typical performance on standard and special cutting tools. Just send a request on your company letterhead asking for Milling Cutter Data No. 4131.

Barber-Colman Company

GENERAL OFFICES AND PLANT, 4131 LOOMIS ST., ROCKFORD, ILLINOIS, U. S. A.

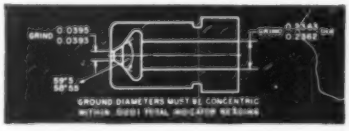
BARBER COLMAN



What's in VERMONT this month?

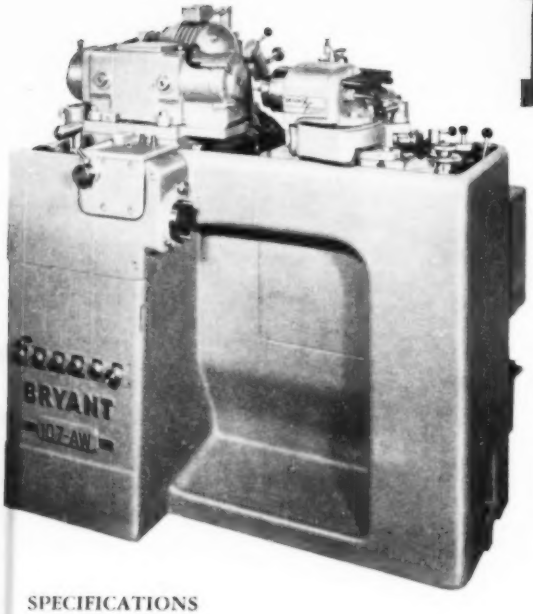
SPECIAL MACHINE FINISH GRINDS INJECTION NOZZLE. Finishing fuel injection nozzles presents a unique group of internal grinding problems. The parts, as a rule, are small and demand extreme accuracy. There are three surfaces to be traverse ground and each one presents its own problem. First, the main bore, which is only .2363 inch in diameter has a seven to one ratio of diameter to length. Second, the tapered seat located at the bottom of this bore is to be traverse ground to an angular tolerance of one minute. Third, the .0394 inch hole, because of its extremely small size, demands grinding wheel speed far in excess of anything previously available. Fourth, a one-tenth concentricity is to be maintained on all three surfaces.

The Bryant Chucking Grinder Co. of Springfield, Vermont, has developed the No. 107-AW internal grinder for finishing injection nozzles at one chucking. Outstanding features include preloaded ball bearing slides for rigidity, an auxiliary angular slide for traverse grinding the tapered seat, Hi-Frequency wheelheads for speeds up to 100,000 r.p.m., and a precision workhead indexing from one wheel to the other to maintain con-



centricity. Some specifications for this machine may be found on the back of this page. For more complete information, arrangements will be made to show a 16 mm sound and color film on the No. 107-AW and other Bryant machines. . . . It won't cost to inquire.

Bryant Chucking Grinder Co. • Springfield, Vermont, U.S.A.



BRYANT

Number 107-AW

INTERNAL GRINDER

The 107-AW is a standard machine for grinding two bores and an angular seat all on a common axis — see other side of page. Other Bryant equipment will grind holes through the complete range up to 60-inch diameter swing. Write to the factory for full information.

SPECIFICATIONS

Total swing	9 inches
Maximum traverse	6 inches
Maximum hole depth	3 inches
Angular slide adjustable from 25° to 45°	
R.P.M. of work spindle	up to 5,000 R.P.M.
Net weight	3,200 lbs.
Floor space — 60 inches x 50 inches (with coolant tank)	

SLIDES
Preloaded ball slides for cross, longitudinal and auxiliary angular motion.

WORKHEAD
Ball bearing spindle. Variable speed electric drive, to 5,000 R.P.M.

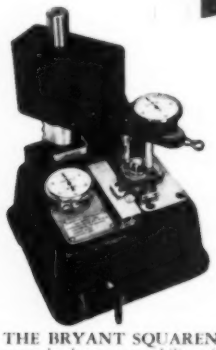
WHEELHEADS (Two)
Ball bearing, Hi-Frequency, speeds up to 100,000 R.P.M.

TRAVERSE
Mechanical, powered by variable speed electric motor.

CROSS FEED
Powered by variable speed electric motor.

POWER
Standard A.C. current.

You can "*See the Difference*" with a BRYANT GAGE



THE BRYANT SQUARENESS-OF-FACE GAGE not only shows acceptability of threaded parts, but also visually indicates the right angularity of the face with the pitch diameter of the thread. The squareness-of-face gage may be mounted on any Bryant bench gage.

It is no longer necessary to "feel for fit" with plug and ring gages when inspecting threads. The Bryant Thread Gage shows, on a dial indicator, whether a thread will assemble properly with its component.

At a glance, anyone can compare threaded parts with a master and tell the whole story immediately — size, presence of burrs, out-of-roundness, accumulated inaccuracies of pitch, lead, diameter and thread form.

It's fast too. The design incorporates three thread segments, two stationary and one movable. The segments are operated by a thumb lever — the part is dropped between the segments — the lever is released, causing immediate contact of segments to threads — a one third turn of the part inspects it all over.

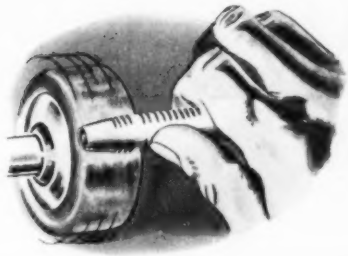
Send samples or drawings for a complete story on how Bryant can save inspection money for you.

Bryant Chucking Grinder Co. • Springfield, Vermont, U.S.A.

BETTER FINISHES...

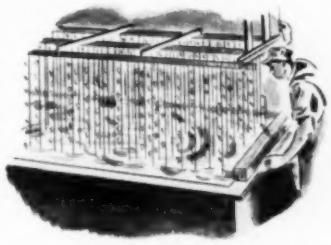
MECHANICAL FINISHES...

polished, buffed, scratchbrush, satin, sandblasted, tumbled, burnished . . . aluminum takes all of them.



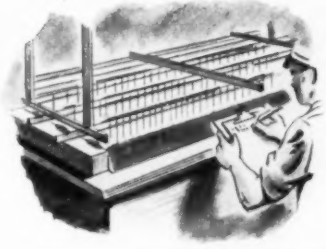
CHEMICAL AND ELECTROCHEMICAL FINISHES...

frosted, etched, and patented Alumilite and Alrok finishes give unusual effects in lustre and color . . . add resistance to corrosion and wear . . . provide excellent painting surfaces.



ELECTROPLATING...

aluminum parts, after suitable surface preparation, take chromium, nickel, gold, silver, copper and brass plating with standard equipment.



PAINT, LACQUER AND ENAMEL FINISHES...

all may be applied following the general techniques used for painting other metals ... good surface preparation, priming, etc.

Another reason for making the most of your Alcoa Aluminum Screw Machine Stock

In making the most of the Alcoa Aluminum Screw Machine Stock available, add to your bonuses of fast machining, high economy and peak performance, another advantage . . . the variety of finishes you can apply. Only aluminum takes the Alcoa patented Alrok and Alumilite finishes that seal vivid colors in the metal surface, add extra wear resistance. Painting and plating finishes require only standard equipment.

It pays to use Alcoa's help in making aluminum do an exceptional job on your parts. Learn the finishes that best suit each screw machine alloy. Start by asking for copies of "Finishes for Alcoa Aluminum" and "Alcoa Aluminum in Automatic Screw Machines". Your nearby Alcoa sales office will supply you, or write ALUMINUM COMPANY OF AMERICA, 1709G Gulf Building, Pittsburgh 19, Pa.

GOOD MACHINING PRACTICES SAVE METAL

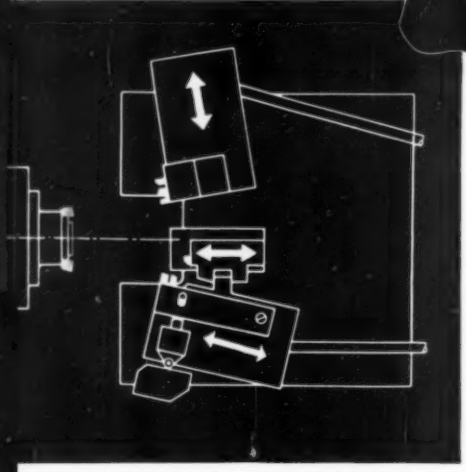
ALCOA ALUMINUM

ALCOA ALUMINUM

INGOT • SHEET & PLATE • SHAPES, ROLLED & EXTRUDED • WIRE • ROD • BAR • TUBING • PIPE • SAND, DIE & PERMANENT MOLD CASTINGS • FORGINGS • IMPACT EXTRUSIONS
ELECTRICAL CONDUCTORS • SCREW MACHINE PRODUCTS • FABRICATED PRODUCTS • FASTENERS • FOIL • ALUMINUM PIGMENTS • MAGNESIUM PRODUCTS

the GISHOLT SIMPLIMATIC

Works All the Angles...



THE SIMPLIMATIC's large platen table provides a platform upon which tool slides may be mounted in any position. Above is a typical tool layout—designed for machining bevel gear blanks. Angular feeds are no problem. Compound slides are seldom needed. Write for literature.

THE GISHOLT ROUND TABLE represents the collective experience of specialists in machining, surface-finishing and balancing of round or partly round parts. Your problems are welcomed here.

COMPLETE FREEDOM IN PLACING TOOL SLIDES

... enables you to meet your own specific needs for high-speed automatic machining ... and do it with a standard machine.

GISHOLT MACHINE COMPANY

Madison 10, Wis.

TURRET LATHES · AUTOMATIC LATHES
SUPERFINISHERS · BALANCERS · SPECIAL MACHINES

131% DIVIDEND

IN ONE YEAR*

The Messinger Mfg. Co., Tatamy, Pa., makers of Insecticide Dusters, Threshers, Corn-Shellers and Woodworking Machinery are reaping the benefits of Turret Lathe Productivity.

131% of the funds invested in Jones & Lamson Turret Lathes were repaid to the purchaser in one year of operation.

* Both large and small lot production of sheaves, bearing caps, blowers, blower cases, worm gear housings, etc., are now turned at peak economy on Jones & Lamson Universal Turret Lathes. One year's savings, based on direct costs alone, more than paid for three machines complete with equipment!

Messinger Mfg. Co., famous for over 90 years' experience in producing agricultural implements, reports that six obsolete lathes were replaced – with capacity to spare. Savings were due to carbide tooling, to the elimination of second operation arbor work (accurate bored jaws were faster and easier) and to the ability of the new machines to hold and repeat exact size settings by means of multiple stops.

Even if your present machines are less than 10 years old, the purchase of a new Jones & Lamson Turret Lathe may be justified through *direct savings alone!* Let us determine YOUR possible savings. **Write to Dept. 710H for this free service.**

Turret Lathe Division

J&L JONES & LAMSON MACHINE COMPANY
Springfield, Vermont, U.S.A.

MACHINE TOOL CRAFTSMEN SINCE 1835

Boost net output per machine

Install AUTOMATIC ROD MAGAZINES on your Brown & Sharpe Automatics

3 EFFICIENCY-BOOSTING ADVANTAGES

- Magazine inserts bar automatically as needed . . . in minimum amount of time.
- Greatly simplified restocking provides ample time for operator to supervise quality and finish of work more closely . . . and on more machines.
- Increased net production more nearly approaches gross or geared output.

BROWN &

BETTER WORK — LOWER COSTS

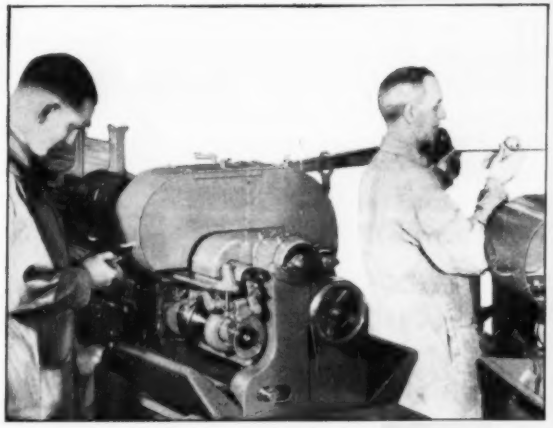
With the Automatic Rod Magazine, a screw machine operator is free to check work pieces more frequently and to pay closer attention to tool conditions . . . maintaining desired quality and producing parts at a minimum cost.

INCREASED OPERATING EFFICIENCY

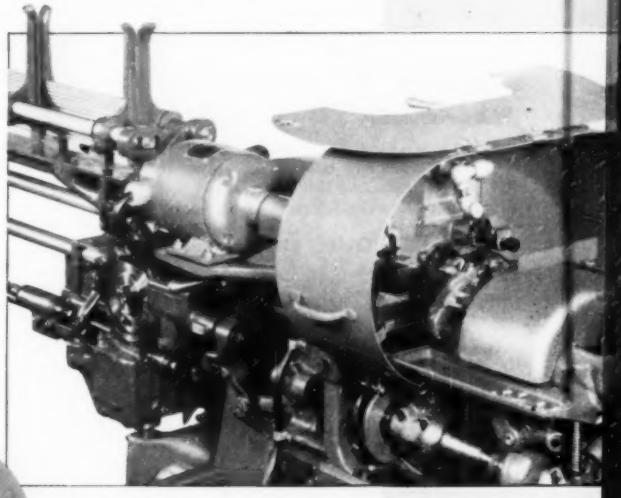
Here's how the Brown & Sharpe Automatic Rod Magazine increases operating efficiency. (1) The magazine permits loading of stock at any time (2) The feeding mechanism takes a new rod automatically the instant it's needed and feeds it into position for trimming.

Electrically-controlled magazines are made for Brown & Sharpe Nos. 00G and 0G Automatic Screw and Cutting-Off Machines . . . also for Automatic Screw Threading Machine. Mechanically-operated magazine is made for No. 2G Machine. Magazines take commercial 10 ft. bars; 12 ft. capacity available.

Investigate the production advantages of Automatic Rod Magazines for your plant. Send for complete information. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.



Compare the value of these screw machine operators. In foreground, operator utilizes his skill to full capacity because his machines are equipped with Automatic Rod Magazines that require infrequent stocking. Other operator must spend much of his time restocking — less time on tool maintenance and quality of work.



Every 3½ minutes this Automatic Screw Threading Machine consumes a 10 ft. bar, ¼" diam., in making screws like those shown at left. Its Automatic Rod Magazine holds 33 of these bars — two hours' supply. Magazine can be reloaded any time during this period. Without magazine, reloading involves over 15 interruptions an hour, making operation of more than two machines and close work-supervision difficult for one operator.

SHARPE B·S

Here's the steel to improve automatic screw machine operation

U·S·S FREE-MACHINING **MX** BAR STOCK

HAS UP TO 20% GREATER MACHINABILITY . . . DEFORMS READILY

U·S·S FREE-MACHINING **MX** BAR STOCK

INSURES FASTER PRODUCTION . . . INCREASES OUTPUT

U·S·S FREE-MACHINING **MX** BAR STOCK

IMPROVES FINISH . . . REDUCES REJECTS . . . LENGTHENS TOOL LIFE

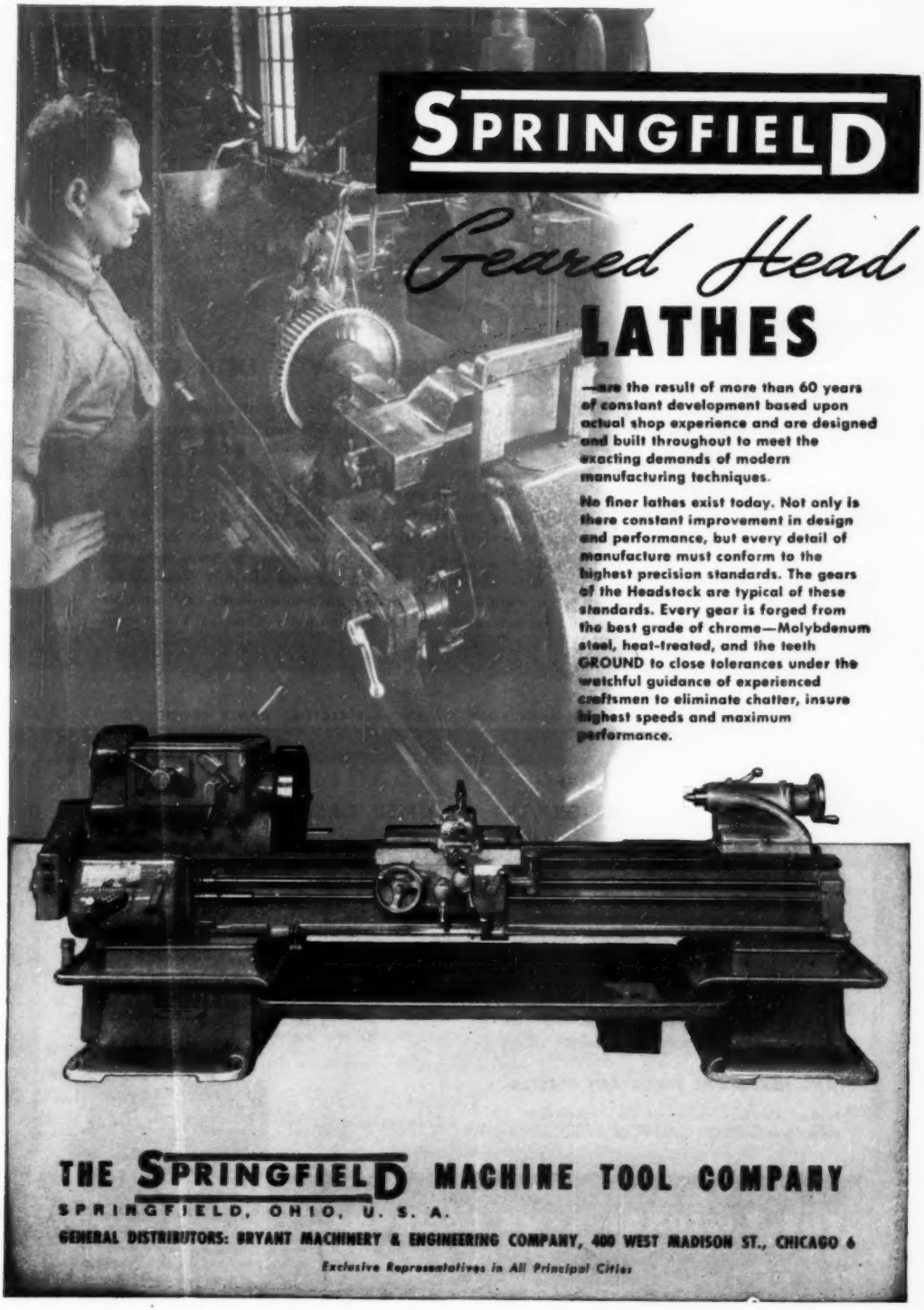
WHY not find out how this new free-cutting bar stock works on your equipment? It may be just what you need to improve your product quality or to cut your costs. You can obtain U·S·S Free-machining MX in cold finished bars from your regular supplier. In hot-rolled bars, MX is available through our nearest district sales office. A qualified metallurgical representative will gladly discuss its possibilities with you.

USS

CARNEGIE-ILLINOIS STEEL CORPORATION, PITTSBURGH AND CHICAGO
COLUMBIA STEEL COMPANY, SAN FRANCISCO
TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM
UNITED STATES STEEL SUPPLY COMPANY, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

9-1668

UNITED STATES STEEL



SPRINGFIELD

Geared Head LATHES

—are the result of more than 60 years of constant development based upon actual shop experience and are designed and built throughout to meet the exacting demands of modern manufacturing techniques.

No finer lathes exist today. Not only is there constant improvement in design and performance, but every detail of manufacture must conform to the highest precision standards. The gears of the Headstock are typical of these standards. Every gear is forged from the best grade of chrome—Molybdenum steel, heat-treated, and the teeth GROUND to close tolerances under the watchful guidance of experienced craftsmen to eliminate chatter, insure highest speeds and maximum performance.

THE SPRINGFIELD MACHINE TOOL COMPANY

SPRINGFIELD, OHIO, U. S. A.

GENERAL DISTRIBUTORS: BRYANT MACHINERY & ENGINEERING COMPANY, 400 WEST MADISON ST., CHICAGO 6

Exclusive Representatives in All Principal Cities

a way to get lower unit costs

Even if your board of directors is made up predominantly of men who are nontechnical—bankers, lawyers and the like—they'll all recognize this truth: three factors effect unit costs. They are materials, man-hours and machine overhead. When *lower* unit costs are the objective, one of these three must "give".

We can't help you much on material costs—except by reducing spoilage (Acme-Gridley automatics have a reputation for "more good pieces in the pan"). But when it comes to man-hours and machine overhead, modern Acme-Gridleys can cut costs appreciably, as compared to obsolete automatics—and any multiple spindle bar automatic built before the war is obsolete. You'll want to support that statement with actual case studies to prove your point. Below is one—more are available on request.

CUT THIS OUT FOR USE WHEN YOUR BOARD OF DIRECTORS WANTS PROOF

AN ACME-GRIDLEY CERTIFIED CASE STUDY

THIS IS WHAT HAPPENED:

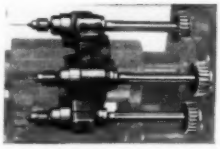
PART TURNED—Roller Skate Cone.

FIRST METHOD—10 years ago we tooled up an Acme-Gridley Model R to turn this part in 3.3 seconds. The part then had to be rehandled for a separate operation; counterboring the back end.

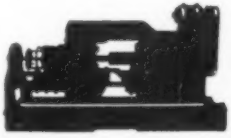
PRESENT METHOD—An Acme-Gridley Model RA6 turns this part *complete*, including counterbore, with pickup and back-facing attachment, in a total time of 3.25 seconds—at an over-all cost-saving of 40%.

AND HERE'S ONE IMPORTANT REASON:

Because the basic design of all Acme-Gridley Automatics provides ample space in the tooling zone, a wide variety of standard and special independently-operated end and side-working attachments may be applied to increase production, improve finish, perform secondary operations, or reduce man-hours.



Three independently-operated, high-speed drilling attachments are used on this cone job.



ACME-GRIDLEY BAR and CHUCKING AUTOMATICS built in 4, 6 and 8-spindle styles, maintain accuracy at the highest spindle speeds and fastest feeds modern cutting tools can withstand.

THE NATIONAL ACME COMPANY
170 EAST 131st STREET • CLEVELAND 8, OHIO

The patented Knurled Cup Point of this popular "UNBRAKO" Socket Set Screw makes it a Self-Locker, because the edges of the counter-clockwise knurls positively prevent creep, regardless of the most chattering vibration. *"It won't shake loose!"*
Pat. & Pats. Pend.

The patented Knurled Threads of this "UNBRAKO" Socket Set Screw are swaged—making it a most excellent Self-Locker for applications requiring cone, oval, flat or other points except cup, and for use with hardened shafts. *"It won't shake loose!"* *

UNBRAKO

SELF-LOCKING SET SCREWS

KNURLING MAKES THESE SET SCREWS "STAY PUT"

"...They Won't Shake Loose"—that's why more and more manufacturers are specifying these screws to reduce downtime and repair costs... to increase production, speed deliveries and protect customer goodwill.

Their exclusive *knurling* makes them exceptionally vibration-resistant, prevents "creep" and subsequent loosening of the screws. They "stay put", even under the most chattering vibration.

UNBRAKO *Self-Locking* Set Screws can be real "Vibration Insurance" for *your* production machinery. And remember, they make an impressive selling point when you use them on your finished products. Our folder 658-1 gives you further details. Write for yours today!

Knurling of Socket Screws originated with "Unbrako" in 1934.

**These screws are not carried in stock. Prices are available on application.*

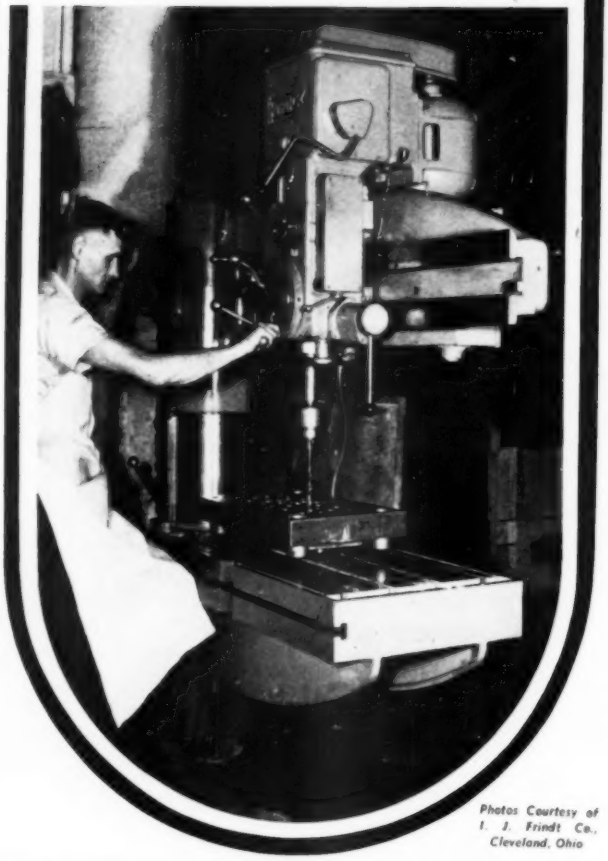
SPS STANDARD PRESSED STEEL CO.

BOX 4 JENKINTOWN, PENNSYLVANIA

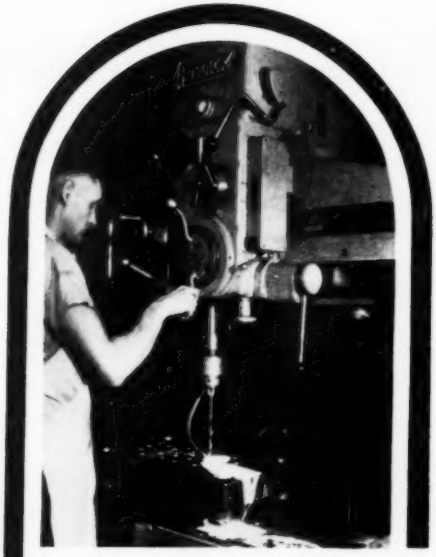
"Serving Industry continuously since 1903 through Industrial Distributors"

A Sensitive Drill with all the advantages of Radial design

FOSDICK
SENSITIVE
RADIAL



Photos Courtesy of I. J. Frindt Co., Cleveland, Ohio



• The All around utility of this Sensitive Radial appeals to both management and machine operators. To the operator because of its convenience and ease of operation and to management because of the wide range of sensitive work it handles and low cost of operation.

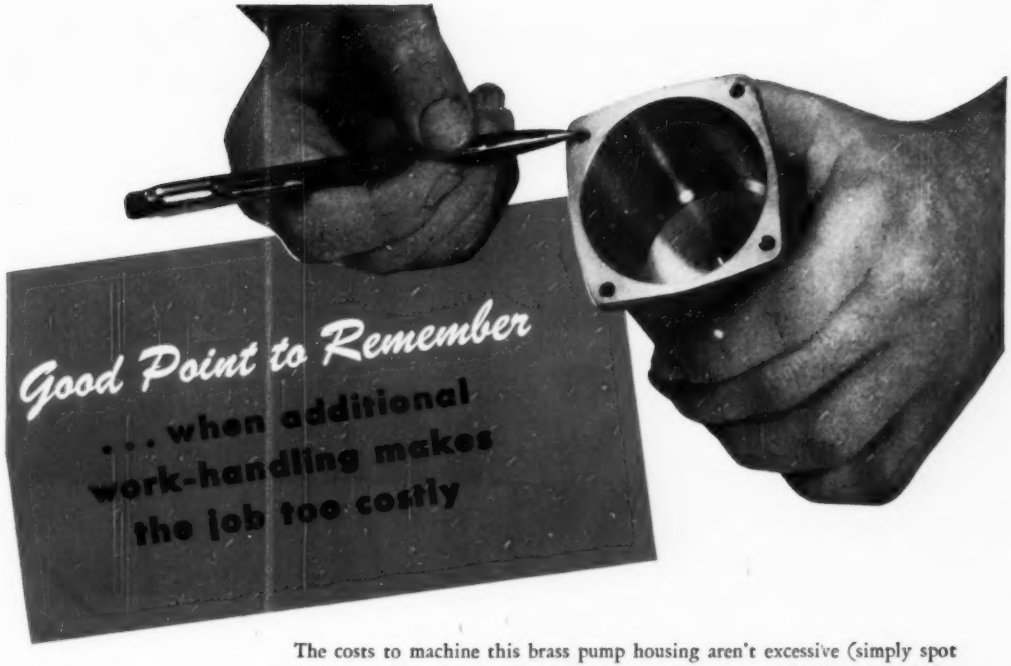
For example the arm at fixed height and the adjustable table both swinging in an arc of 360° provides maximum flexibility and job utility. The table can always be located in the correct position for the job at hand. The Conventional radial type base is always available for taller jobs with the table swung out of operating position.

There are nine speeds and four feeds. Both feeds and speeds are controlled by direct reading levers on the head. All controls for movement of the head and spindle, power feed etc. are within easy reach of the operator.

Whether you operate a large plant or a small one here's an economical machine to handle your sensitive drilling operations especially where you have a wide variety of work in small lots.

For detailed information on the machine, capacities and specifications—*write for the New Fosdick Sensitive Radial Bulletin R.S.A.*

FOSDICK MACHINE TOOL *Company*
CINCINNATI 23, OHIO



The costs to machine this brass pump housing aren't excessive (simply spot drilling, boring, facing, chamfering) — until it comes to drilling the 4 holes in the flanges. There's the rub: *extra* handling . . . and *extra* costs. P&J Tooling on the P&J Automatic solves the cost problem with tungsten carbide tooling, and . . .

THE P&J-DESIGNED SELF DRIVEN MULTIPLE SPINDLE DRILLING ATTACHMENT which is automatically indexed into exact alignment — to drill and c'sink the 4 holes in one operation while the work spindle revolves. Machining time is reduced . . . unnecessary work-handling eliminated. Good points to remember!

Of course no two jobs are alike. P&J engineers will gladly apply their 50 years' tooling experience to *your* job. A time study and cost estimate are yours for the asking. Simply send details and a sample part or prints.

P&J AUTOMATICS

and P&J Tooling are designed at "Production Tooling Headquarters" to profitably machine a wide range of chucking and turning work. Because the job illustrated is within 4" dia., it's a snap for the P&J 3U Automatic. Complete literature on the 3U will be sent upon request.

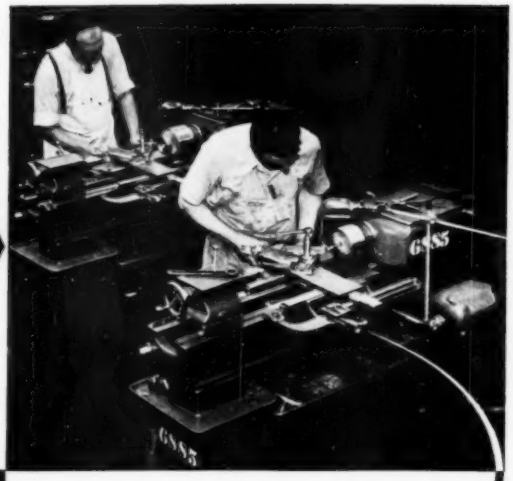
Potter & Johnston Company

Pawtucket, R. I.

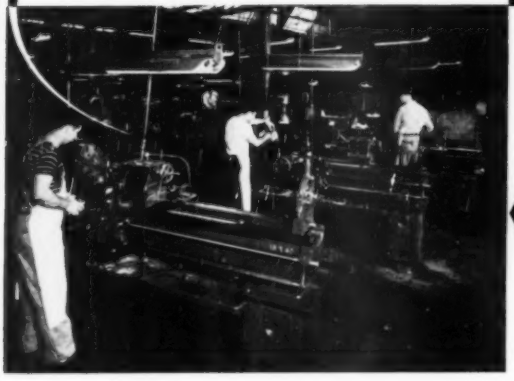
subsidiary of Pratt & Whitney
Division Niles-Bement-Pond Company

P&J

from Connecticut

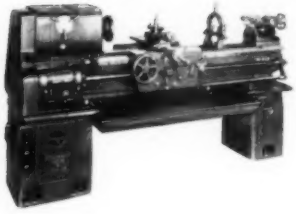


Two 10" Tray-Top Cintilathes in use in the shop at Pratt & Whitney Aircraft, West Hartford, Conn.



Three Tray-Top Cintilathes in service at Wells Aircraft Parts Company, Los Angeles, Calif.

to California



Wells Aircraft bought its first Tray-Top a year ago and after six months ordered two more. Mr. Elmer Wells writes: "... Our work is of an experimental nature or short run jobs on aircraft which demand high grade finishes, close tolerances and trustworthy lathe alignments ... We believe the **Ground Ways** are an important factor in producing accurate work ... Our operators find the 1200 rpm and twelve speeds to be a decided advantage, particularly in changing from steel to aluminum parts of varying sizes and diameters ... The enclosed **Quick Change Gear Box** is a good feature; it eliminates chips from clogging the gears."

Before you buy your next light duty engine lathe, examine the sound practical features of Tray-Top Cintilathes. Add them up and you'll find the "Twenty-Feature" Tray-Top Cintilathe gives you the most utility for the least investment. Swing sizes: 10", 12½", 15", and 18". 15" and 18" sizes available with gap and gap block. Write for Bulletin T-100-2. Cincinnati Lathe & Tool Co., Cincinnati 9, Ohio.

cintilathe

TWENTY-FEATURE TRAY-TOP

A SAVING OF $8.00 PER PIECE

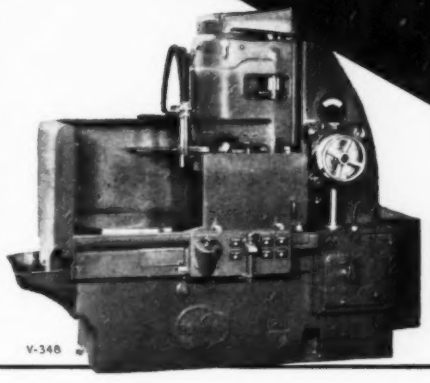
WHEN THEY.... PUT IT ON THE BLANCHARD

Yes, this special alloy stainless steel ring 28" x 2½" x 9/16" was finish ground on the No. 18 Blanchard Surface Grinder with 36" chuck at a saving of $8.00 per piece over previous method.

Machining this alloy stainless steel ring by the previous difficult method cost $9.00 per piece. The combination of Blanchard Grinder, Blanchard Engineering, and wheel selection reduced production cost to $1.00 per ring. One side was ground removing .070" of metal to close dimension and flatness tolerances.

Here again is proof positive that the most profitable words in flat surface machining are "Put it on the Blanchard."

Are you machining your flat surface the most economical way? Talk it over with Blanchard.



Send for your free copy of "Work Done on the Blanchard", third edition. This new book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

Send for your free copy of the first edition of "Art of Blanchard Surface Grinding." This newest of Blanchard books shows you how to get best production results with Blanchard Surface Grinders.

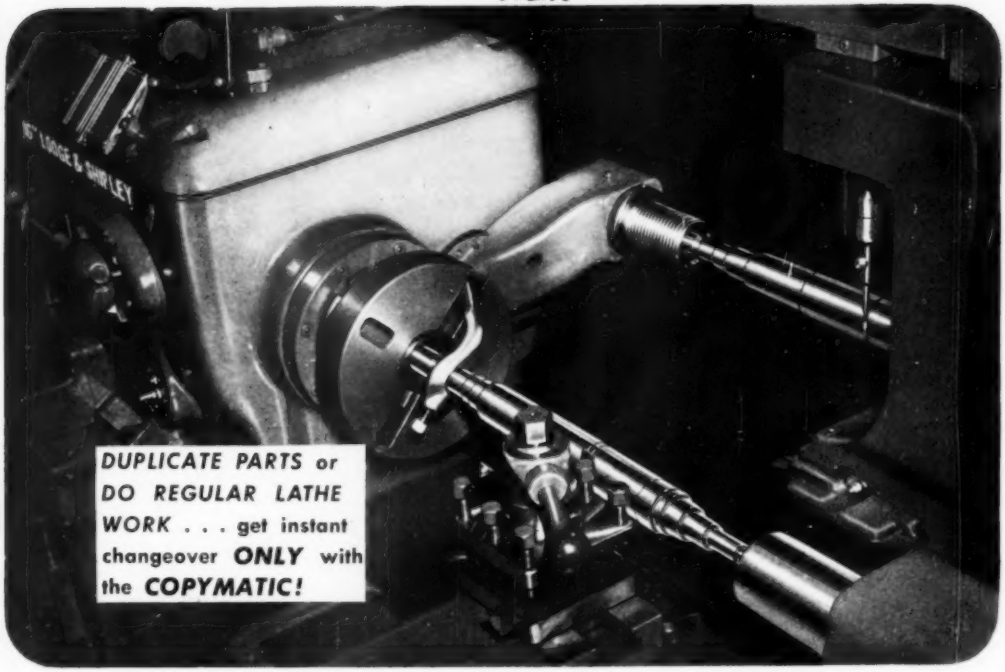
BLANCHARD

The BLANCHARD MACHINE COMPANY

64 STATE STREET, CAMBRIDGE 39, MASS., U. S. A.

TURNING TIME CUT 1/2

at LINK-BELT COMPANY, Philadelphia
with the *NEW* LODGE & SHIPLEY COPYMATIC Lathe



● Quickly recognized by industry, the versatility and exceptional productive capacity of the New Lodge & Shipley COPYMATIC Lathe is already serving many alert manufacturers. One of these is the Link-Belt Company, whose Philadelphia Plant reports 50% savings in machining time plus other economies . . . on the COPYMATIC. Numerous exclusive Lodge & Shipley profit features are termed "Excellent."

The illustration above shows one of "various general lathe jobs" performed on the 16 in. Model "X" COPYMATIC Lathe. A motor shaft of SAE 1040 heat-treated steel is being turned, grooved and radii finished by automatic tracer control. NOTE: *Link-Belt is using a stock shaft for the template, eliminating cost and time involved in making a special template . . .* typical of the simplicity of operation designed into the COPYMATIC.

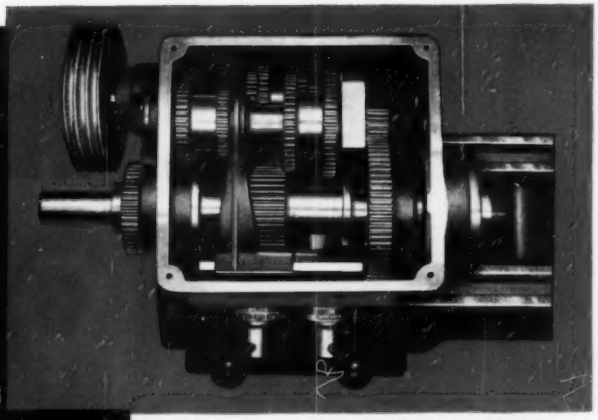
If you're looking for more and better production . . . check the COPYMATIC. This newest development, combining the speed and convenience of automatic duplication . . . proven "Model X" efficiency . . . and instant changeover from duplication to regular lathe operation, is the talk of the shop and cost department too! Write for Bulletin No. 675.

THE **Lodge & Shipley** COMPANY

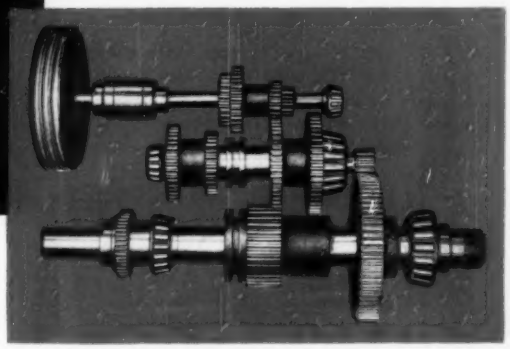
MACHINE TOOL DIVISION • 3055 COLERAIN
SPECIAL PRODUCTS DIVISION • 800 EVANS ST.
CINCINNATI 25, OHIO

More Powerful Head

- ✓ Oversized Heat-Treated Steel Gears
- ✓ Timken Tapered Bearings
- ✓ Unusually Large Spindle, Rigidly Mounted
- ✓ Rugged Shifting Mechanism
- ✓ Extra-Heavy Casting
- ✓ Automatic Splash Lubrication

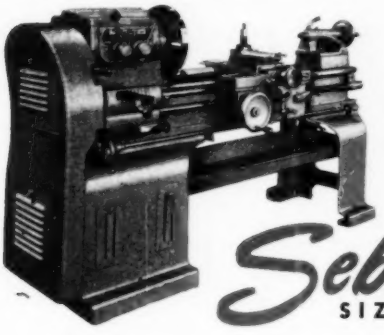


SEBASTIAN 8-SPEED GEARED HEADSTOCK
Interior view showing sliding gear transmission.



Timken Bearings and heat-treated steel gears on all headstock shafts assure more power, longer service life.

The above special headstock features assure more power, extra-high accuracy, and exceptionally low maintenance in the modern "King-made" Sebastian Lathe. In addition, the following features provide a superior ease and all-around efficiency of operation which make this *finer* Sebastian an outstanding leader in the medium-price engine lathe field:



Shaved headstock gears for quiet operation . . . Neutral point in head permits revolving spindle freely by hand for chucking work . . . Large hole through spindle . . . Headstock completely sealed . . . Multi-colored, direct-reading control dials for obtaining spindle speeds quickly and easily . . . Reverse in apron for feeds—adds to operating convenience . . . 57 feed and thread changes . . . Taper gibs . . . Apron control for start, stop, and reverse of lathe spindle (standard on lathes with 10′, 12′, and 14′ beds—also available on other bed sizes).

SEBASTIAN DEALERS ARE LOCATED IN PRINCIPAL INDUSTRIAL CENTERS

Sebastian GEARED HEAD LATHES

SIZES 12", 16", 20"

See your nearest Sebastian Dealer. Ask him or write us for Catalog S-1 (Standard Lathes) and S-101 (Special Type Lathes —Gap, Clutch & Brake, etc).

American Steel Foundries

KING MACHINE TOOL DIVISION

CINCINNATI 29, OHIO

Builders of King Vertical Boring & Turning Machines and Sebastian Lathes

"bumper" production at Houdaille-Hershey

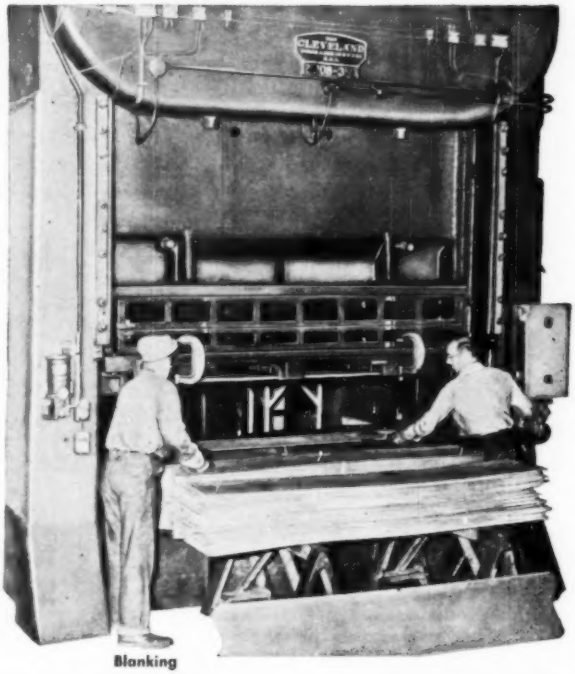
WITH CLEVELANDS

When the Huntington Division of The Houdaille-Hershey Corporation set up their high output production schedule for automobile bumpers, Modern Cleveland Presses were selected for the job.

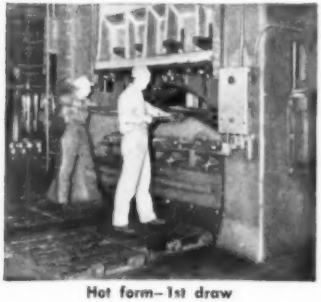
The four principal bumper stamping operations are shown in the accompanying sequence photographs. Houdaille-Hershey's battery of Modern Cleveland Presses consists of Two-Point and Four-Point models.

Cleveland's rugged construction is your assurance of longer die life . . . less downtime . . . increased production . . . more economical operation. Every type of Cleveland Press offers you these same operating advantages. Included in the Cleveland line are: Inclinable, Horning, Punch Type, Gap Type, Straight Sided, Trimming, Knuckle Joint, Double Action Toggle and Single Point.

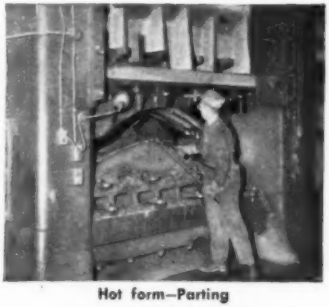
For complete information on these or other types of Modern Cleveland Presses, write for a copy of our folder 74 today.



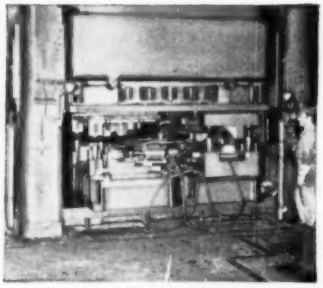
Blanking



Hot form—1st draw



Hot form—Parting



Trimming

THE CLEVELAND PUNCH & SHEAR WORKS CO. U.S.A.

Established 1880

PUNCHING TOOLS & DIES

FABRICATING TOOLS

OFFICES AT:
NEW YORK....CHICAGO
DETROIT....PHILADELPHIA
PITTSBURGH

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THE GREENFIELD STORY

of Service and Quality

Specials

IF all the "special" taps which "Greenfield" has made in the last 75 years were brought together, they would make a fantastic display of styles, shapes and sizes of threading tools.

File cases full of drawings and blueprints attest to the ingenuity and experience of "Greenfield" men in designing special taps for all kinds of applications. These files are a storehouse of knowledge for "Greenfield" engineers to use in meeting new problems or in duplicating previous orders even after a lapse of many years.

To handle orders that are not covered by the thousands of different "regular" taps listed in "Greenfield's" catalog, there is available not only a large staff of engineers but also a complete separate plant just for making "specials". Fast delivery and low cost on "specials" is convincing testimony to "Greenfield's" tap-making ability.

GTD

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Greenfield, Massachusetts

and

THE GEOMETRIC TOOL CO.
New Haven 15, Connecticut

and

GTD AMPCO **AMPCO TWIST DRILL CORP.**
Jackson, Michigan

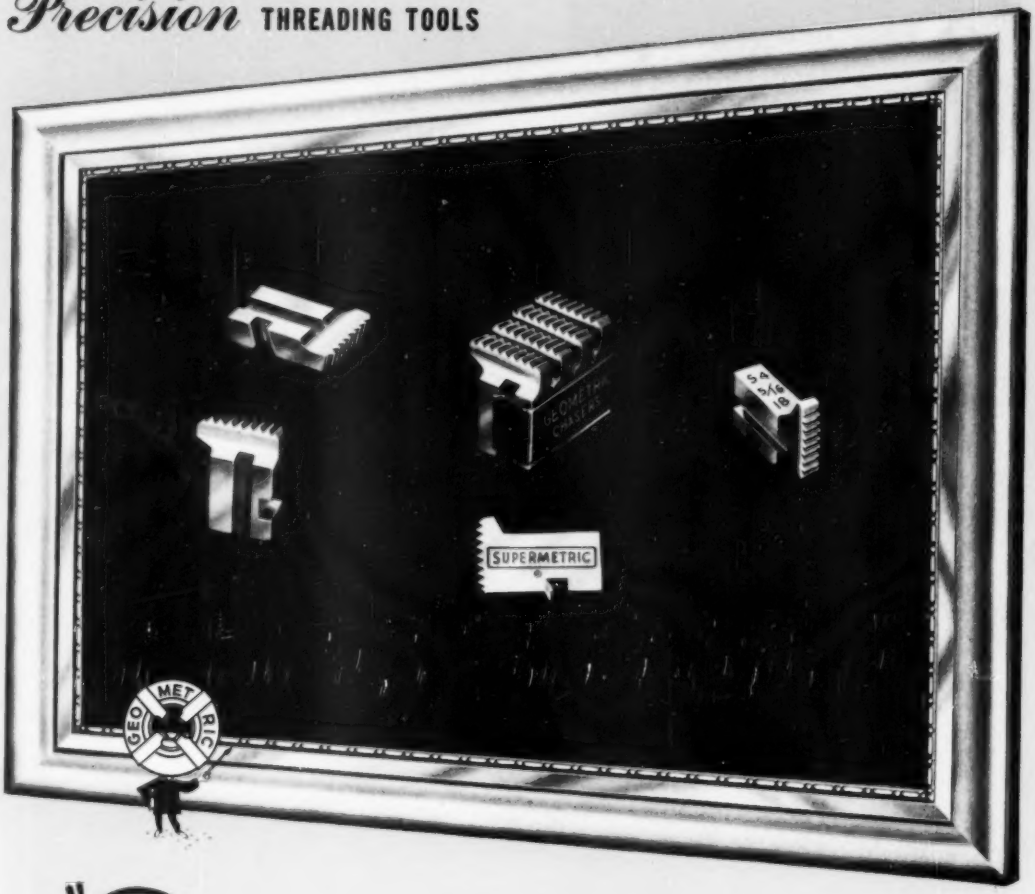
Divisions of Greenfield Tap and Die Corporation

GTD

GREENFIELD

Be Sure
Buy "Greenfield"

Precision THREADING TOOLS



"Supermetric"

Ground Thread Chasers.... Superior Finish!

Newest development in chasers, with the threads, keyways, cam lug slots and other surfaces finished to a high degree of precision and smoothness.

* *

NOW . . . Available for 9/16" Styles D, DS and DJ . . . in addition to 5/16" Styles DS and DJ Geometric Die Heads.

* *

GEOMETRIC also makes a complete line of Rotary and Stationary Self Opening . . . and Solid Adjustable Die Heads—Collapsing . . . and Solid Adjustable Taps—and GEOMETRIC Chasers.

"Be Sure ... Buy Geometric"

THE
GEOMETRIC
TOOL COMPANY, NEW HAVEN 15, CONNECTICUT

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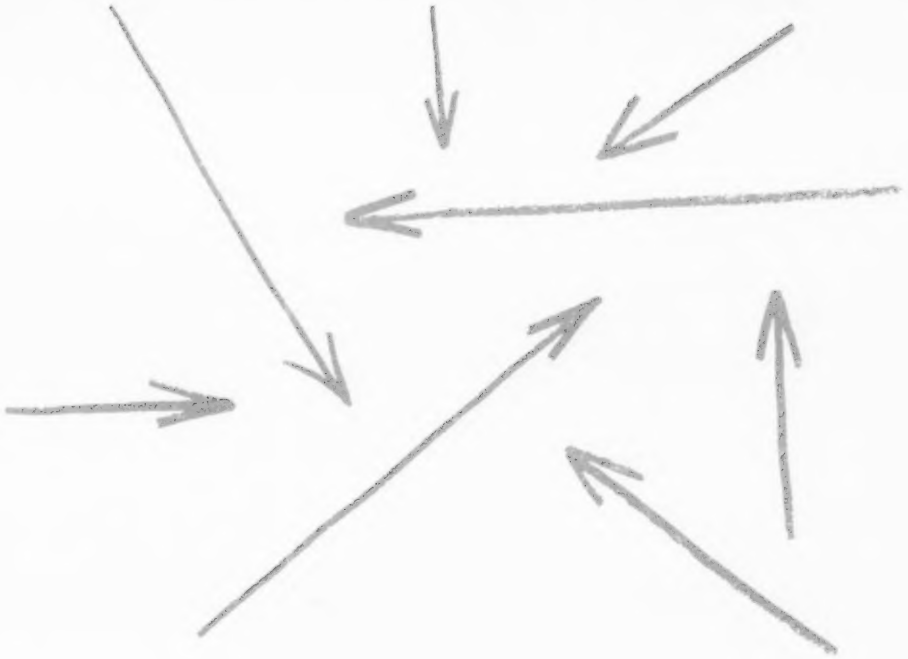
GTD AMPCO



They're all the same to a TIMKEN® bearing

NO MATTER from what direction the loads may come, Timken® roller bearings carry them all safely—dependably. Timken bearings are tapered in design—carry both radial loads, thrust loads and any combination of them.

With Timken bearings in your product, auxiliary thrust bearings and thrust plates are eliminated. Designs can be simplified, space saved, cost reduced.

You have a better-working product, too. The tapered construction of Timken bearings prevents end-play and holds shafts in proper alignment. Wear on surrounding parts is reduced; gears mesh more smoothly.

And Timken tapered roller bearings give you these added advantages: Due to the line contact between rolls and races, they have extra load carrying capacity. True rolling motion and smooth surface finish practically eliminate friction. Timken bearings permit the use of closures which keep lubricant in—dirt out. And since they're made of Timken fine alloy steel, Timken roller bearings normally last the life of the machine in which they are used.

Dependable performance and public acceptance of Timken bearings have made Timken-bearing-equipped products first choice throughout industry. They add a valuable sales feature in your product—build greater acceptance among customers. When you specify bearings for your product, specify "Timken". And when buying new equipment, always look for the trade-mark "Timken" on the bearings. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO".

50th birthday of the company whose products you know by the trade-mark: TIMKEN

TIMKEN 50 YEARS

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

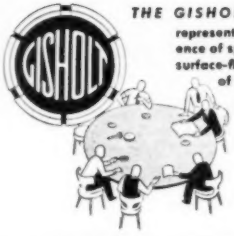
TAPERED ROLLER BEARINGS

Close-up of *DANGER!*

The main bearing of this small crankshaft was originally finished by a mechanical sanding machine. Then it was partially Superfinished—just enough to reveal the lack of adequate bearing capacity. Light abraded areas are the only true geometrical surface. Dark areas are low spots which carry no bearing load. The area contact of the Superfinishing stone brings out deficiencies in production which were never intended by the designing engineer.

For more information on Superfinishing, write on your company letterhead for the new textbook, "Wear and Surface Finish."

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin



THE GISHOLT ROUND TABLE
represents the collective experience of specialists in machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

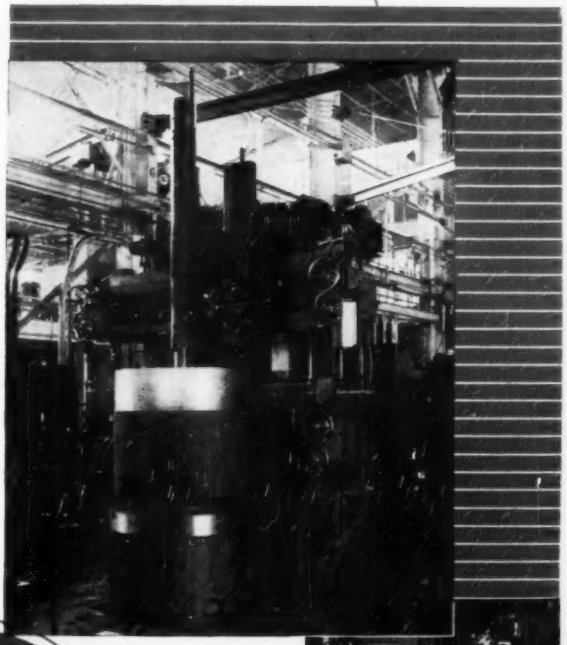
TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

Rugged Work in a Foreign Land

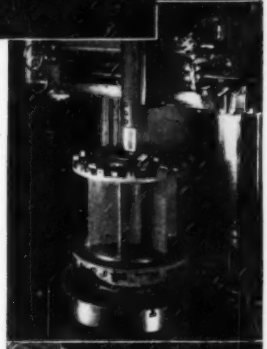
Requires an Especially

Rugged Machine

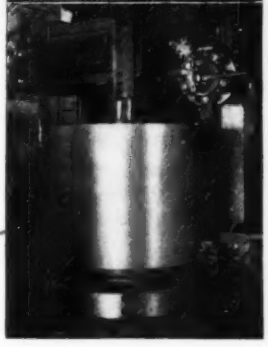
Selection of Bullard Cut Master for foreign duty bespeaks confidence in Reliability of Performance with minimum liability of breakdowns.



BULLARD



Fixture and Bull Center used to hold the work rigid. →



This 54-inch high bed **Bullard Cut Master** going to India was selected for this tough job because of its especially rugged construction.

The 3 Head combination exactly met the requirements of this particular job.

Main Ram Head with anti-friction bearing Bull Center holds the internal fixture rigid against the heavy cutting required.

Side Head takes a long heavy cut with three tools on the full length of outside diameter. Then an interrupted undercut is made on the bottom surface to finish-off numerous lugs.

At the same time undercutting is in operation, the Turret Head is used to face-off the lugs on the top surface.

Write for circular illustrating Cut Master's rigid construction and describing its manufacturing refinements.

THE BULLARD COMPANY

BRIDGEPORT 2, CONNECTICUT

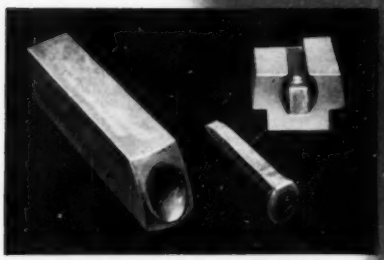
Steel-Weld FABRICATION

In these Steel-Weld Fabricated combined engine beds and crankcases, and cylinder blocks for marine diesels, is further evidence of the type of workmanship you can expect from Mahon craftsmen. No matter what your requirements may be, regardless of size or weight, the Mahon Company is prepared to turn out smoother, finer appearing Steel-Weld Fabricated parts and assemblies to your specifications. Complete machining facilities, capable of handling heavy, cumbersome pieces of unusual dimensions, are available for either rough or finished machine work. These facilities, plus the long experience of Mahon Steel-Weld design engineering experts, assure you every advantage of Steel-Weld Fabrication.

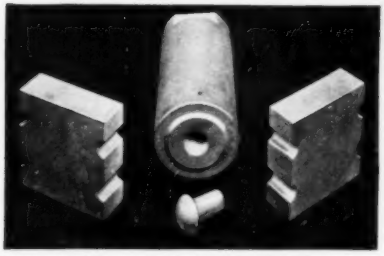
THE R. C. MAHON COMPANY
Detroit 11, Michigan

Engineers and Fabricators of Welded Steel Machine Bases and Frames, and Many Other Welded Steel Products

MAHON



Tool costs took a nosedive when Hot-Work 8 was used for the hot-forging of steel spikes up to 5/8-in. square. Spike production now averages 200,000 for dies; 3,100,000 for grippers; and 1,100,000 for pointers. Even longer life is obtained in the production of smaller spikes.



Longer tool life resulted when Hot-Work 8 was used for these header and gripper dies in the semi-automatic manufacture of steel rivets. These dies outproduce other hot-work steels previously used. One set of dies turns out 45,000 rivets of 5/8-in. to 3/4-in. size in 8 hours.

Quick Facts about HOT-WORK 8

TYPICAL ANALYSIS:	C	Cr	Mo	V
	0.60	3.60	8.50	1.75

RED-HARDNESS: High. Excellent resistance to heat-checking and surface wash. Withstands repeated drastic cooling.

WEAR-RESISTANCE: High. For maximum service life in the medium- and high-temperature ranges. Hot-Work 8 gives excellent service life in applications where the tool or die reaches temperatures as high as 1400 F. The material being worked has, of course, much higher temperatures.

SHOCK-RESISTANCE: Good. Stands up under heavy impacts.

HEAT-TREATMENT: Anneal at 1600 F, furnace-cool. Pre-heat to 1600 F prior to hardening. Harden at 2150 to 2200 F, followed by air-quench. Temper at 1120 F for best wear-resistance; at 1200 F for best shock-resistance. Rockwell C-44 to 55.

Write us for your copy of the new booklet, "Bethlehem Hot-Work Tool Steels."

Bethlehem HOT-WORK 8

improves high-temperature TOOL LIFE

Hot-Work 8 is a veteran hot-work tool steel that cuts tool costs because of its high wear-resistance in the higher range of operating temperatures. High resistance to surface wash and heat-checking also account for its long service life on severe hot-work applications. It all adds up to longer life, fewer redressings . . . and lower costs.

Choose Hot-Work 8 when temperatures are high or variable; and when the tool or die is subject to drastic cooling during operation. Hot-Work 8 is versatile because of its excellent balance of properties for such applications as crowners, dollies, hot punches, stamps, striking dies, hot headers, hot shear blades, hot stamps, trimmers, and gripper dies. Full details are available from the nearest Bethlehem sales office or tool-steel distributor.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

Export Distributor:
Bethlehem Steel Export Corporation

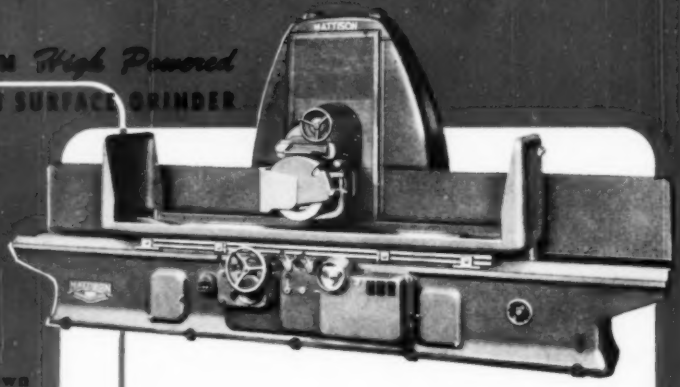
BETHLEHEM STEEL

HOT-WORK 8...one of Bethlehem's Fine Tool Steels

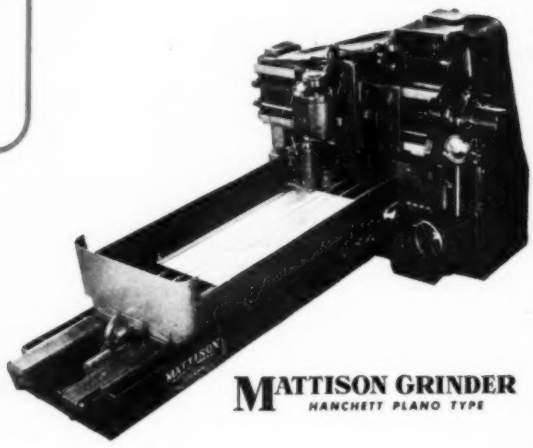
MATTISON GRINDERS

MATTISON *High Powered*
PRECISION SURFACE GRINDER

● Mattison Machine Works, Rockford, Illinois has purchased the line of Production Grinding Machinery formerly made by the Hanchett Manufacturing Company of Big Rapids, Michigan. These machines will supplement the well-known line of Mattison High Powered Precision Surface Grinders and enables Mattison Machine Works to offer machines for handling practically all of your Surface Grinding problems on a low cost, high-production basis.



For further information on any of the Grinders listed, ask for free circulars containing complete specifications and operating data.



MATTISON GRINDER
HANCHETT PLANO TYPE

***Grinders now built by* MATTISON**

SURFACE GRINDERS: High-Powered, Precision, Horizontal Spindle —Rotary Type, Vertical Spindle— Rotary Automatics, Vertical Spindle — Reciprocating Table Type, Vertical Spindle — Plano Type, Horizontal and Vertical Spindle.

FACE GRINDERS: Traveling Table (Hydraulic) and Traveling Wheel.

DISC GRINDERS: Single Spindle, Double Spindle, Vertical Spindle, Automatic Single Wheel.

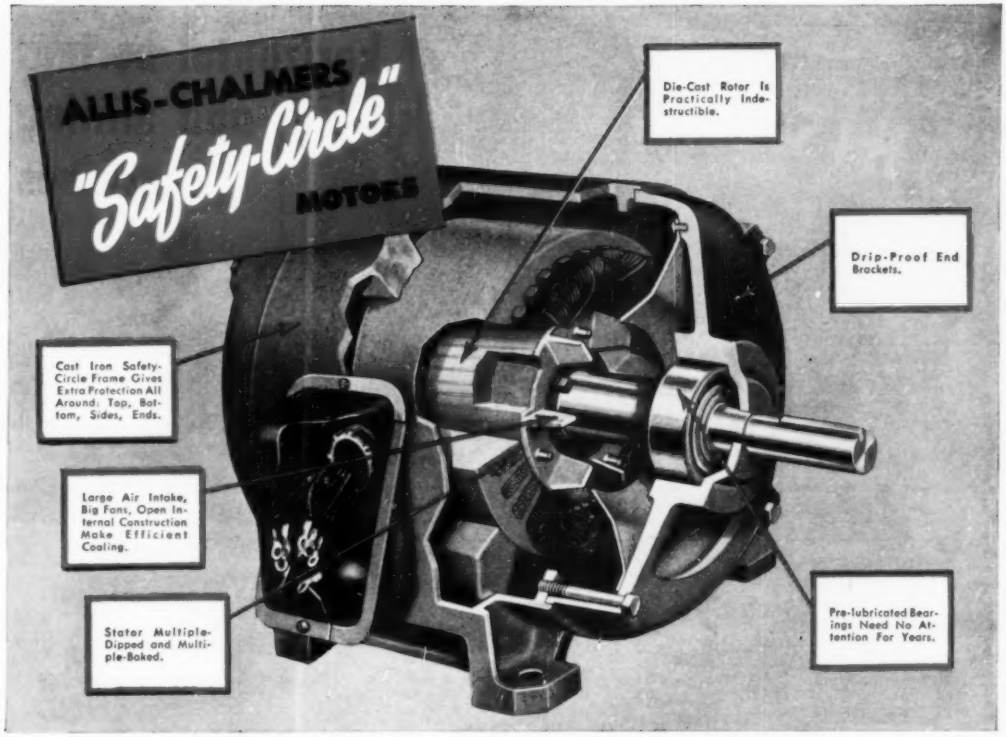
WAY GRINDERS: Vertical Spindle for dovetails and undercuts.

ABRASIVE-BELT GRINDING AND POLISHING MACHINES for wide steel sheets, strip steel, internal tube, etc.

● For years Mattison Machine Works has successfully built High-Powered Precision Surface Grinders and will continue to build the same high quality into the entire line — through sound principles of engineering, precision manufacturing, careful workmanship and modern methods of production. Our reputation for service and careful attention to machines in the field will naturally extend over the complete line of Grinders now built by Mattison.

When in need of service or repair parts, present owners of Hanchett Grinders should contact Mattison Machine Works, Rockford, Illinois.

MATTISON MACHINE WORKS
ROCKFORD · ILLINOIS


ALLIS-CHALMERS
"Safety-Circle"
MOTORS
Die-Cast Rotor Is Practically Indestructible.
Drip-Proof End Brackets.
Cast Iron Safety-Circle Frame Gives Extra Protection All Around: Top, Bottom, Sides, Ends.
Large Air Intake, Big Fans, Open Internal Construction Make Efficient Cooling.
Stator Multiple-Dipped and Multiple-Baked.
Pre-lubricated Bearings Need No Attention For Years.

HOW SAFETY-CIRCLE

Means Motor Dependability

EXTRA PROTECTION means extra dependability. That's why Allis-Chalmers protects the working parts of the motor with the exclusive SAFETY-CIRCLE. Compare this motor with motors of less rigid construction. The SAFETY-CIRCLE motor will not distort in mounting or under strain. And you get the extra protection of drip-proof end brackets at no premium.

EXTRA PROTECTION INSIDE, TOO

Stator is multiple-dipped and multiple-baked in special insulating varnish. Rotor is die-cast aluminum. Stator is mounted in four longitudinal ribs which leaves plenty of air space between stator and frame. Large fans cast integrally with the rotor and ample air intakes keep temperatures well within rated limits. *Ball bearings are factory-lubricated and require no further attention for years.*

When you shop for motors, remember SAFETY-CIRCLE gives you *extra protection, extra dependability* and *lower operating costs.*

For details on SAFETY-CIRCLE advantages, see your A-C Authorized Dealer or Sales Office or write for Bulletin 51B6210B. Sizes 1 to 20 hp, 326 frames and smaller. *Safety-Circle, Texrope* and *Vari-Pitch* are Allis-Chalmers trademarks.

ALLIS-CHALMERS, 999A SO. 70 ST. A-2691
MILWAUKEE, WIS.

ALLIS-CHALMERS

Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

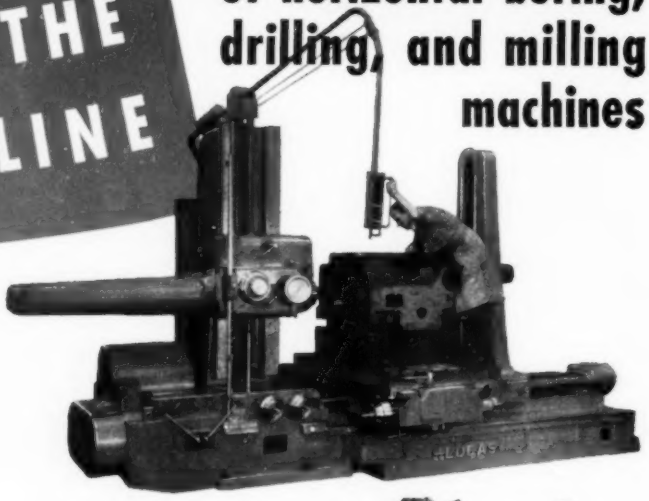
CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE — Belts in all sizes and sections, standard and Vari-Pitch sheaves, speed changers.

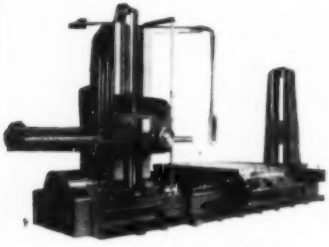
PUMPS — Integral motor and coupled types. Sizes and ratings to 2500 GPM.

THIS IS THE LUCAS LINE

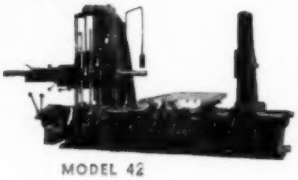
of horizontal boring, drilling, and milling machines



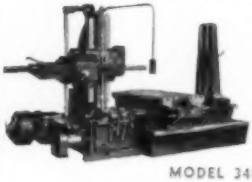
MODEL 460



MODEL 548



MODEL 42

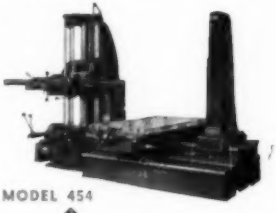


MODEL 348

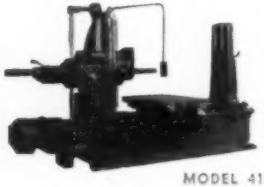
Well described as "one man machine shops", these versatile machines combine precision with ruggedness that makes them equally valuable for tool room work and as production machines.

Available with mechanical controls in 3" and 4" spindle capacities. Full directional remote electrical control models with 4", 5", and 6" spindles. Work ranges are from 36" x 36" to 94" x 84". Two or four way beds available in all sizes.

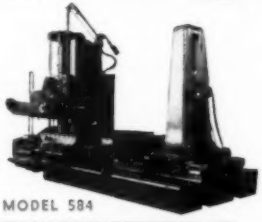
Fine feeds, high and low speed ranges to a single spindle, accurate spacing without jigs are among the features which make all Lucas models adaptable to many kinds of work and keep them in constant productive use in any shop. *Available with automatic power positioning dial indicators for repetitive, close tolerance work.*



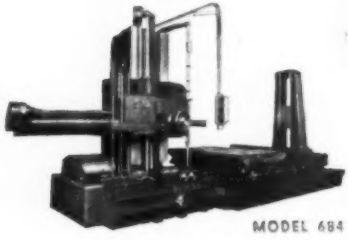
MODEL 454



MODEL 41



MODEL 584



MODEL 484

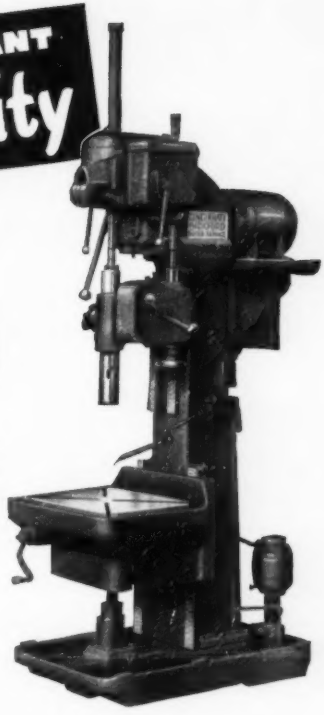
LUCAS OF CLEVELAND

LUCAS

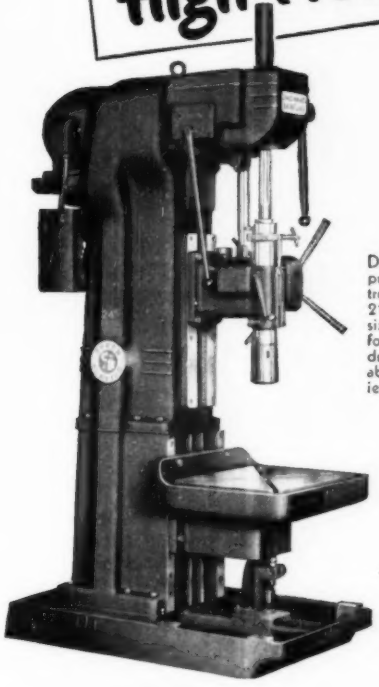
Precision

HORIZONTAL BORING, DRILLING AND MILLING MACHINES
LUCAS MACHINE DIVISION, THE NEW BRITAIN MACHINE CO.
CLEVELAND, OHIO

WHEN YOU WANT Versatility



WHEN YOU WANT High Production



All geared, sturdy, accurate and versatile, furnished in 21", 24", 28" sizes. Built in both box type and round type to suit the particular need.

Direct Drive, with push button control of motor—in 21", 24" or 28" sizes. Simplified for low cost production, yet adaptable and convenient.

Opportunity of selection means increased value to the buyer—the power to select exactly the machine suited to the particular job.

Cincinnati Super Service Upright Drills are built in production, and all geared types—one for high production, and on the other, versatility of performance.

Both types of these modern, up-to-date upright drills are sturdy, fast and rigid. They give long, trouble-free performance, and assure the user "low cost per hole."

Write for bulletin U-27 (Direct Drive Production Super Service Uprights) and bulletin U-25 (All Geared Super Service Uprights).

THE CINCINNATI BICKFORD TOOL CO.

SUPER SERVICE

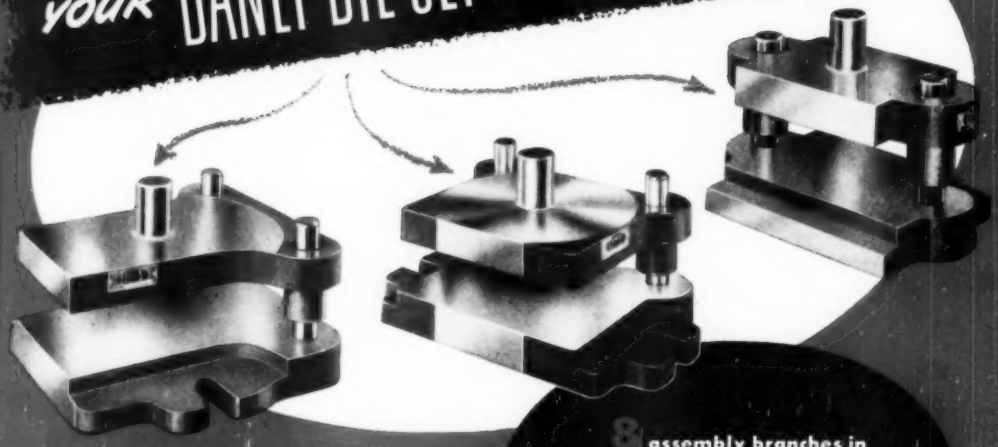
RADIAL AND UPRIGHT DRILLING MACHINES

Radials 7½" dia. col., 2½" arm, to 56" dia. col., 12' arm.
General purpose Uprights, 21" to 28" sizes.
Production Uprights, 21" to 28".
Jig Borers, Portable Horizontals, Spacing Table Machines.

Equal Efficiency of Every Unit Makes the Balanced Machine

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.

YOUR DANLY DIE SET IS ONLY HOURS AWAY!



8 assembly branches in key locations stock all standard Danly Die Set components for *immediate* assembly and delivery!

Just select the standard Danly Set that meets your requirements...from the thousands of interchangeable combinations listed in the Danly catalog ...and phone, wire or write your nearest Danly branch. Prompt, efficient delivery will eliminate costly delay.

And Danly Precision Die Sets will make your dies last longer, too! Ground and lapped leader pins and bushings assure accurate die relationship.

For faster service and longer die life, always specify a Danly Die Set.

Write for this Free Bulletin

...and see how Danly's special die set machining service will mean important savings in your tool shop

Which DANLY branch is closest to you?

*Chicago 50, 2100 South 52nd Avenue
*Cleveland 14, 1550 East 33rd Street
*Dayton 2, 990 East Monument Avenue
*Detroit 16, 1549 Temple Avenue
*Grand Rapids, 113 Michigan Street, N.W.
*Long Island City 1, 47-28 37th Street
*Los Angeles 54, Ducommun Metals & Supply Co., 4890 South Alameda
Milwaukee 2, 111 East Wisconsin Avenue
Philadelphia 44, 18 West Chelten Avenue
*Rochester 4, 16 Commercial Street

** indicates complete stock*

DANLY *PRECISION DIE SETS...standard and special*

Danly Machine Specialties, Inc.
2100 SOUTH 52nd AVENUE, CHICAGO 50, ILLINOIS

OVER 25 YEARS OF DEPENDABLE SERVICE TO THE STAMPING INDUSTRY

SPOT NEWS OF METALWORKING

Small gear wheels and other small machine parts are being made experimentally from powdered copper, using a special frit as a bonding agent. A similar frit has been employed for a long time as a bonding agent in making grinding wheels.

Experimental cars with modified versions of fluid-magnetic clutch are being tried out on proving grounds by two of the larger automobile companies.

Budd is reported to be building a power railroad car equipped with torque converter for foreign sale.

Signs of the times: One of the largest steel companies now is happy to book orders for as little as 2½ tons for delivery within 15 days.

Skoda Works in Czechoslovakia has delivered 50 light 25-hp tractors for shallow ploughing to the Bombay government in India. Switzerland is to ship to India 50 steel railway coaches a year, beginning in early 1950. Cars will be fitted in Indian shops.

India should have a fourth automobile assembly plant working on British components by next year. Standard Motors will establish a plant in Madras to produce 6000 units a year. There then will be seven large-scale car assembly operations in India: Ford assembling U.S. and British models; General Motors assembling GM and Vauxhall; Premier assembling Chrysler units; Hindustan assembling Morris and Studebaker; Ashok assembling Austins; and Motor House Gujerat assembling Kaiser-Frasers; and Standard.

Special rolling tables for rolling of platinum and its alloys are being delivered to the Soviet Union by the Skoda Works.

Measuring surface inclinations to accuracy of a quarter of a degree by touch is now possible for blind technicians. Developed by American Foundation for the Blind, the level consists essentially of a highly polished steel ball rolling in a highly polished brass angle section. Inclination is read from a dial at one end of the level. (See Story p.100 for other tools for the blind.)

Inserted-tooth broaches are under test by Pratt & Whitney Aircraft for machining the pine-tree form on gas turbine parts. This design doubles chip clearance and permits accurate backing off. Because usual broaching machines do not have a long enough stroke, the broaches are mounted on a planer, with the work on the crossrail.

Shortage of 100,000 lb. of magnesium sheet a month for military requirements has led the armed services to try to find new facilities. Several metalworking companies are experimenting with the problem, and one already is rolling small amounts of magnesium sheet.

Titanium for aircraft parts has many advantages over other materials, states an important aircraft maker. Uses for this new metal will be developed as rapidly as it becomes commercially available.

More than 100 long-range test flights a year with guided missiles will be made from proving ground being established at Cape Canaveral in Florida under Air Force direction for all the armed services. Missiles will be launched southeast across Bahamas on which observation stations will be located and will be continuously under control.

Gaging Metalworking

Increasing evidence is at hand that the inventory adjustment period, which has had a depressing effect upon metalworking operations, may be shorter than many observers had anticipated.

▸ That some lines have already seen the turn is shown by copper and lead prices. Both metals have had sharp recoveries in prices from last spring's lows.

▸ Steel users also are likely to be back in the market in a big way by the fourth quarter. A recent on-the-spot check made by AMERICAN MACHINIST revealed that steel users have sizable inventories, but will be ready to buy again by October.

▸ Typical example: purchasing department of a large consumer failed to scrape together a third-quarter order for one-fourth of its normal requirements. But its releases for the final three months of the year will be close to 1948 average requirements.

Metalworking Index Stays Up

Metalworking operations during June stayed almost on a level with May, going down only one point to 199 on the AMERICAN MACHINIST Index of Metalworking Production. The retreat which began early in the year and continued through the month of May thus was brought almost to a halt. During that period, the index declined 20 points (manhours worked in 1939 equals 100). It is interesting to note again that metalworking activities still are double the 1939 volume.

It is clear that the terrific pace maintained by the automobile industry was responsible for the strong June showing. The automotive component, one of five comprising the index, rose from 202 in May to 216 in June. In effect, this was a reflection of the ups and downs of the Ford Motor Co., which was strike-bound during May.

Three of the components—machinery, electrical manufacturing and transportation (other than automobiles)—fell in June. Machinery was hardest hit, dipping 9 points.

Sentiment Looking Up

As a matter of record, sentiment in many metalworking lines is looking up a bit. Though the shaking-down process may not have been completed, management is rapidly adjusting its thinking and plans onto a realistic basis. The fall season ahead looks better than it did 30 days ago.

This improvement in feeling has not been translated into increased orders as yet, but it is believed to be a forerunner of better bookings.

Automobile Assemblies Very High

Capital equipment and consumer durable goods continue to be the main source of strength in metalworking. Motor car assembly is extraordinary for this time of year. It promises well for August, barring strikes.

Turbines, large motors, generators, transformers and switchgear, dependent in the main upon the public utility industry, are helping to sustain operations at almost double the 1939 rate, measured in manhours.

Defense business also is an aid. It is taking up the slack in employment here and there.

Subcontracting jobs are scarce. More and more, metalworking companies have drawn into their own shops much work heretofore done outside as their order books shrunk. Government work is about the only exception.

Tool and Die Orders Up

Contract tool and die shops got 7% more new business in May than in April. But the gain was concentrated in a relatively few companies. Employment was steady. For the first time, however, the number of men on direct labor in the average shop slipped under 23.

Average weekly hours was 40. As some shops are known to have been working overtime, others obviously were on less than a 40-hr. schedule.

Backlogs on June 1 were 5% up from May, but still very low. Invoiced sales in the first five months of 1949 were 88% of those in the same period last year.

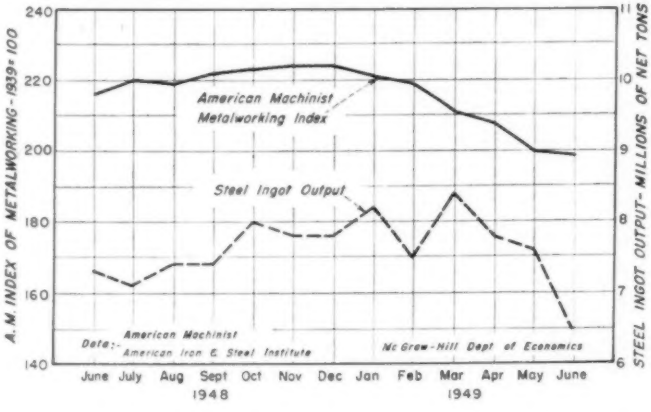
Steel Looks To Fourth Quarter

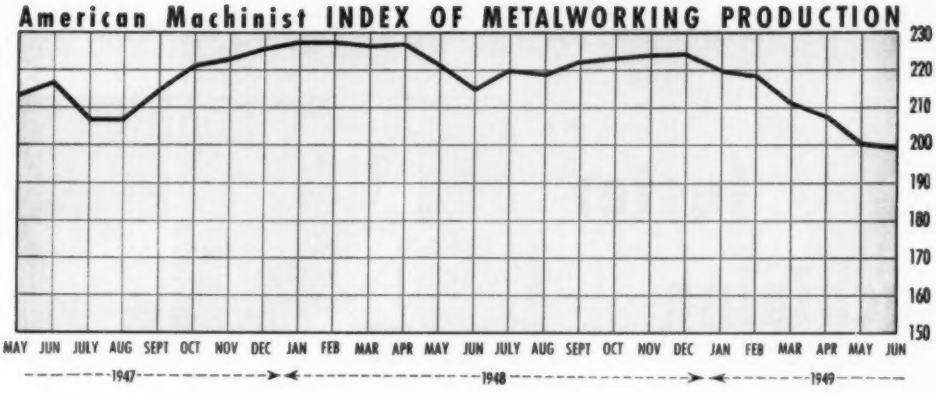
Steel mills probably will not feel a marked pickup in demand before the fourth quarter. Only exception is that users might take more tonnage than they had intended as a "hedge" against possibility of a steel strike.

Even if the strike against U.S. Steel, Bethlehem and Republic had been pulled as scheduled, consumers would not have suffered immediately.

METALWORKING INDEX COMPARED WITH STEEL INGOT OUTPUT

		A.M. metalwkg index (1939-100	Ingot Output (millions of tons)
1948	June	216	7.3
	July	220	7.1
	Aug	219	7.4
	Sep	222	7.4
	Oct	223	8.0
	Nov	224	7.8
	Dec	224	7.8
1949	Jan	221	8.2
	Feb	219	7.5
	Mar	211	8.4
	Apr	208	7.8
	May	200	7.6
	June	199	6.5





INDEX		COMPONENTS				
		MACHINERY	ELECTRICAL MFG.	AUTOS, TRUCKS	TRANSPORTATION EQUIP.	OTHER METALWORKING
June 1949 (preliminary)	199	203	191	216	285	136
May 1949 (revised)	200	212	194	202	288	136
June 1948.....	216	250	227	217	282	148

AMERICAN MACHINIST'S INDEX OF METALWORKING is based on manhours worked in five segments, which are "weighted" as follows: Machinery, 32.5—Auto & Trucks, 22.6—Electrical Manufacturing, 15.4—Transportation Equipment, 12.4—All Other Metalworking, 17.1. Index figures are a percentage of 1939, which equals 100.

Almost all of them are in a comfortable inventory position. Not until some weeks had gone by would the situation have become acute.

Automotive companies, biggest users of all, have been cutting back their steel tonnage to get down to a 20 to 30 working-day supply. Reasons: (1) to use up excessive stocks beginning to rust from outdoor exposure; (2) to reduce inventory costs; and (3) to force mills to return to a prewar basis of doing business, wherein quality standards were guaranteed.

Machine Tool Shipments Rise

Domestic orders for machine tools were down 15% in June compared with May, according to preliminary figures. Thus the downward movement which began in April has continued right up into the summer. It appears likely that July may be slightly lower than June.

▸ Foreign orders in June held up much better than domestic. They were not down more than 5%, and final figures may reveal that they matched the May record. Shipments of machine tools during June rose about 10%. A speeding up of machines for overseas deliveries was responsible for this gain.

▸ It is believed that almost all the ECA-financed machine tools to be bought in the U.S. in the fiscal year 1949 (total of $55 millions) have been placed. Some delay is likely to be encountered in booking ECA orders financed from the 1950 budget because of the slowness of Congress in approving the ECA program.

▸ Stringent curtailment of British buying in this country will not substantially affect machine tools. For several years, only U.S. machine tools not duplicated by types built in Britain were granted import licenses by London. This policy will remain unchanged. Britain is expected to continue to be our best source of foreign machine tool business.

Homebuilding Spurts

Homebuilding, a major market for metalworking products, is in much better shape than expected earlier in the year. The number of homes started in June touched 100,000 as estimated by the Bureau of Labor Statistics, thus topping the 1948 monthly figures for the first time. Last year, builders got a fast start. The steady pick-up in homebuilding since March has given builders a chance to come very close to equaling, or even passing, last year's record number of "starts"—931,000.

▸ As houses are finished three to four months after they are started, appliance makers, hardware lines and other home products manufacturers will benefit. There should be an uninterrupted increase in sales by these companies into the fall season.

Inventories Drop Drastically

The midyear report of the President's Council of Economic Advisors shows how much the "inventory slump" has meant to business. Inventories of non-farm lines, which had been increasing at an annual rate of $1.4 billion in the first quarter, dropped at a rate of $4 billion in April, May and June. That decline is sufficient to account for a major part of the decrease in production.

ECA Aids Industrial Machinery

Export demand from ECA nations will go far toward giving industrial machinery builders highly-needed support in the months ahead. Metalworking machinery other than machine tools, amounting to over $100 million, will be bought in this country. Much of it will be for steel rolling mill equipment.

► It is expected that during the 1950 fiscal year some $905 million of industrial machinery of all kinds will be imported into western Europe from the United States. That compares with $719 million during the fiscal year just closed, a healthy boost. Biggest item, $248 million, will be for petroleum equipment.

Appliance Sales High

Though production of household appliances has dipped sharply in recent weeks, with substantial inventories of finished goods in warehouses, retail sales have been at a high level. In almost all products, the year's retail volume will be far above prewar and will suffer only by comparison with the extraordinary and unprecedented total achieved last year.

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American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

Suggestion Systems Pay Off

What are you doing to stimulate your employees to suggest ideas which will improve your business?

Thousands of firms are engaged in this activity. They offer a financial reward for suggestions which can be put into practical use.

General Electric is a spectacular example. Last year it paid out over $277,000 to 17,629 employees for meritorious suggestions. The largest single award was $2,285 to an employee at Erie, Penn., for an idea to improve the finishing technique on refrigerator cabinets.

The second highest award of $2,000 went to an employee at Fitchburg, Mass., for a method of fabricating nozzle boxes on superchargers for diesel locomotives.

General Electric's suggestion program, like that in many other companies, has a long history. It was started 43 years ago and has been carefully built through the years.

Today, one out of every four employees submits at least one idea each year. About one-third of the ideas are adopted and get an award. The average award last year amounted to $15.72.

Other large companies have duplicated the success of General Electric. But successful suggestion systems are not confined to big corporations. They can be used just as effectively in the medium-size and small shop.

Every metalworking company can improve its techniques—in the shop, in the field and in the office. If it has all or a considerable percentage of its employees thinking about its problems and helping solve them, it will profit far more than if it relies solely on a handful of officials.

A good suggestion program should adhere to a few ground rules. First and foremost is an ample reward for a successful suggestion.

The size of the check paid to the employee should be in keeping with the profit to the company arising from the adoption of the suggestion. If a certain recognizable saving is made, a definite percentage of it should be paid to the man who suggested it.

Beyond an ample reward, the program, once started, should be consistently maintained over a long period. It should be no "fly-by-night" venture.

Top management should take an interest in it and, from time to time, directly promote it. The head of the company should present the rewards at the end of the year to the individual employees. The help of the supervisory force should be recruited, too.

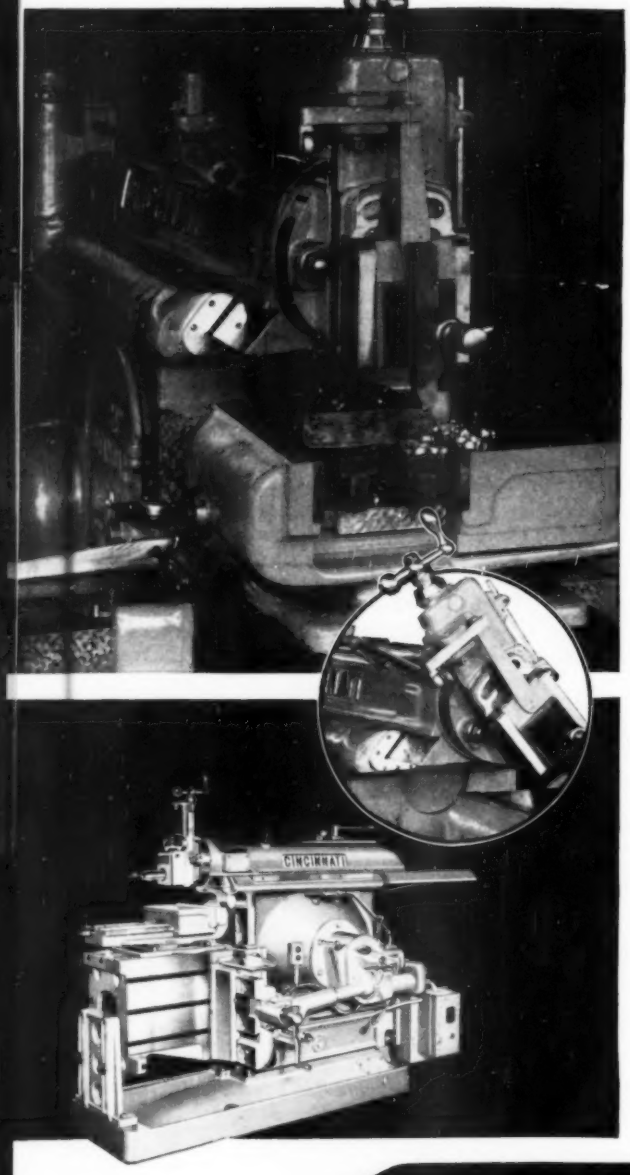
The man on the job is better fitted than anyone else to spot new ways of doing things and of saving money. Management should benefit from his ideas, and he in turn should be compensated for them.

The way to achieve this commendable result is by means of a suggestion program. It should pay off handsomely for you.

Burnham Finney

EDITOR

Millions of cuts . . .



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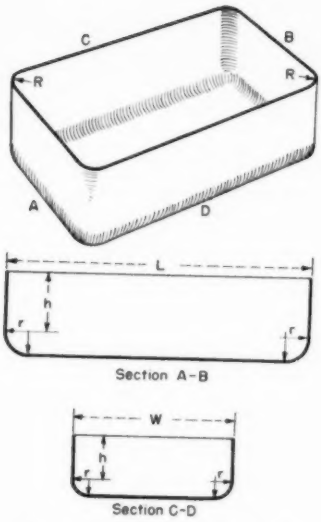


Fig. 1—In drawing seamless rectangular shells, the problem is to develop a sloping curve for the blank corners because excess metal cannot be notched out

HOW TO CALCULATE BLANKS FOR SEAMLESS RECTANGULAR SHELLS

Sloping curves for corners of the blanks are usually approximated: the author shows a Russian's method that is geometrically exact and which avoids folds, tears or excessive thickening

BY SERGIUS D. BROOTZKOOS

PROBLEMS occur in the drawing of seamless rectangular shells that are absent in drawing circular articles.

When processing rectangular shells, Fig. 1, the actual drawing of the metal takes place at the corners only, and the sides are formed by bending. Thus, the action of the metal is unlike that when producing round shells.

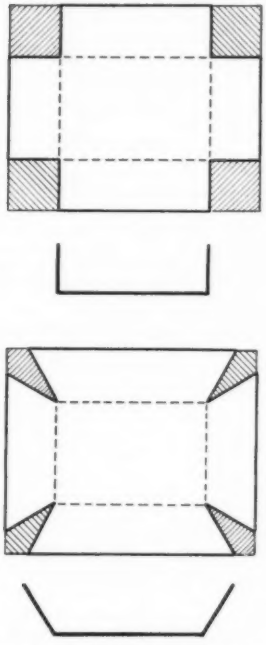
In drawing round shells, the metal in the side walls is subject to uniform plastic deformation all around, whereas in drawing of seamless rectangular articles the plastic deformation of the metal occurs at the corners only, and is not uniform because the metal is free to expand and flow sidewise into the side walls of the shell. This sidewise flow of the metal is noticeable in the seamless-drawn rectangular articles by the presence of flow lines or by the change of color in the metal near the shell corners.

The combination of drawing, side flow and bending of metal during the drawing of seamless rectangular shells creates the problem of finding a shell blank that will assure the proper amount of metal for forming shell corners without ears, folds, tears or excessive thickening, and, if possible, without the necessity for a trimming operation.

The problem of finding the shape of the blank can easily be understood from the study of the blank developments for rectangular shells with welded straight or flared side seams. Fig. 2 shows a straight-walled box with welded side seams and its blank development. In drawing this blank the outline of the box bottom is drawn first (dotted lines) and then an outside rectangle is drawn at a distance from the dotted lines equal to the height of the box.

In order to form the box by bending up the sides of the blank along the dotted lines, the blank has to be notched at the corners to remove the surplus of metal (shaded parts). Similar conditions exist when forming a flared pan, Fig. 3, with the notch size and the amount of the removed metal, however, somewhat smaller than in the previous case.

In drawing seamless rectangular articles, notching of blank corners for removal of surplus metal is excluded. The shape of the blank corners must therefore be developed in such a way as to keep the



Figs. 2 and 3—Blank development for a box with welded corner seams is simple. Square notches are used for a straight-walled box; triangular notches for a flared pan

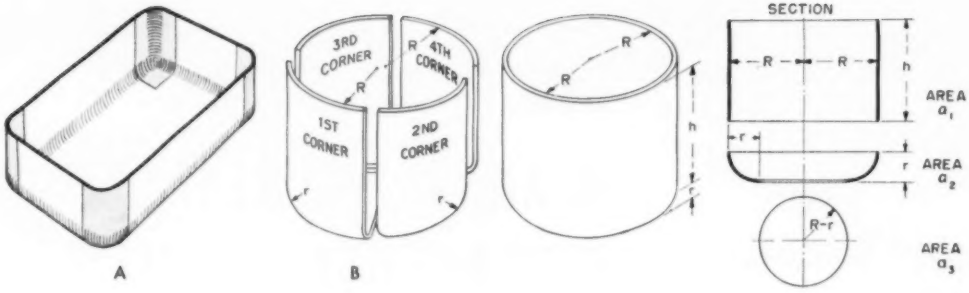


Fig. 4—To find the area of the metal in the corners of the seamless rectangular shell, Fig. 1, it is necessary to calculate the area of an equivalent cylindrical shell with rounded bottom

amount of metal there to a minimum necessary for forming the shell corners without excessive thickening, fold or ear forming, or bottom tearing.

In this article, the discussion is limited to drawing of seamless, straight-walled rectangular shells made of thin stock or tin plate and disregards the negligible thickening and elongation of the stock at the corners during the drawing operation.

Rectangular seamless - drawn shells, Fig. 1, are usually made with rounded side and bottom corners in order to make the drawing of these shells possible. This permits an assumption that the amount of metal for forming all four side corners, sketched should be equal to that required for drawing a cylindrical shell having the same height and bottom radius as in the rectangular shell, and of a diameter double the corner radius.

Since it assumed that the metal in the shell walls does not thicken or elongate during the drawing operation, the area of the disk from which the cylindrical shell can be drawn is equal to its surface area. Thus, we have:

Surface area of cylindrical part of shell:

$$a_1 = 2 \pi Rh,$$

Surface area of bottom curved part:

$$a_2 = 2 \pi r \left[(R - r) \frac{\pi}{2} + r \right],$$

Surface of shell bottom:

$$a_3 = \pi (R - r)^2$$

Surface area of disk for drawing the cylindrical shell, Fig. 4, for drawing all four corners, is then:

$$A = a_1 + a_2 + a_3$$
$$= 2 \pi Rh + 2 \pi r \left[(R - r) \frac{\pi}{2} + r \right] + \pi (R - r)^2$$
$$= \pi (2 Rh + R^2 + 1.141596 Rr - 0.141596 r^2)$$

Since $A = \pi R_c^2$,

where R_c is the radius of the disk,

$$A = \pi R_c^2 = \pi (2 Rh + R^2 + 1.141596 Rr - 0.141596 r^2)$$

Disregarding the last component, which is very small, we have:

$$R_c^2 = 2 Rh + R^2 + 1.141596 Rr$$
$$R_c = \sqrt{2 Rh + R^2 + 1.141596 Rr}$$

This radius can easily be found graphically on the basis of the theorem of plane geometry that "the perpendicular to the diameter of the circle is the mean proportional between the segments of the diameter."

The formula for the disk radius is:

$$R_c^2 = R (2 h + R + 1.14r)$$
$$\frac{R_c}{R} = \frac{2 h + R + 1.14 r}{R_c}$$

thus making the R_c a mean proportional between two other parts of the formula.

The actual size of the disk radius can now be found from a scale drawing of all components in the manner shown in Fig. 5.

Having found radius R_c for the corners of the shell blank, it is now possible to proceed with the layout of the whole blank.

A rectangle A, B, C, D is drawn, Fig. 6, having the width: $W - 2r$ and the length: $L - 2r$. This rectangle represents the flat part of the shell bottom, Fig. 1. By continuing the sides of this rectangle beyond the points A, B, C, D for a length equal to $h + \frac{\pi r}{2} = h + 1.57r$ and connecting the points by lines parallel to the outline of the original rectangle, we get the outline of a shell bank where the bending only is done during the drawing operation.

In order to complete the outline of the blank it is necessary from the points A, B, C, D to draw quadrants with a radius equal to R_c. The blank outline (solid lines) is the theoretical one that assures the

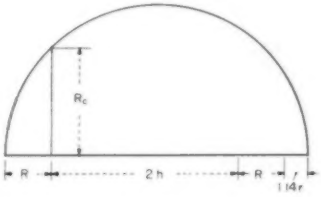


Fig. 5—Radius R_c of the disk for the cylindrical shell calculated from Fig. 4 is solved by use of plane geometry

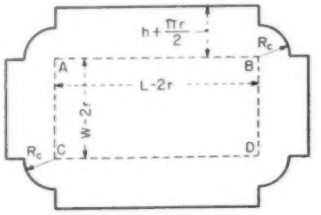


Fig. 6—To start the layout of a blank for a seamless rectangular shell, quarter disks of radius R_c are added to the blank developed for a straight-walled box

necessary amount of metal for drawing the shell. But, if we use the blank, slits, folds and overlaps will occur at the points where the quadrants meet the side walls, when shells are drawn.

Most textbooks on die designing and plastic working of metals merely advise one to join these quadrants with the side walls by gentle sloping curves. This advice does not solve the problem of finding suitable curves and leaves it to chance, sometimes based on previous experience. Such trial-and-error practices lead to loss of valuable diemakers' time and in setting up the press and the die.

The fundamental difficulty in finding these sloping curves lies in the necessity of striking a balance in adding metal to the quadrants and in taking it from the side walls without any change in the total amount of metal required for drawing the shell.

Several approaches for solving this problem have been proposed by various authors on die designing. The solution advanced recently by a Russian engineer, B. P. Zvorono, seems to be logical and practical. His method is discussed below for drawing the three fundamental types of sloping curves for balanced distribution of metal at the corners of the designed shell blanks.

For procedures to find the sloping curves, see Fig. 7, 8 and 9. Proceed thus:

1. Bisect *ab* and *cd*. Through the dividing points *e* and *f* draw *gh* and *ij* tangent to the quadrant arc.

Three cases may now occur as to the position of these tangents with respect to the quadrant arc: the tangents may cross each other either outwardly as shown on Fig. 8; or inwardly, as shown on Fig. 9, or these tangents may coincide, as shown on Fig. 7.

2. Bisect the angles *emn* and *fop* formed by the crossing of a corresponding tangent line with the adjoining outer edge of the side wall.

3. Draw lines parallel to the outer edges of the side walls at a distance equal to the radius R_c until they cross the bisectrices at points x and y.

4. From the points x and y, draw arcs with a radius R_c which will touch the outer edges of the side walls and the tangents *gh* and *ij*. Here the angle formed by the tangents *gh* and *ij* must be bisected. A line is drawn parallel to one of the tangents until it crosses the bisectrice at point *Z*. From this point, an arc with the radius R_c is drawn touching both tangents *gh* and *ij*.

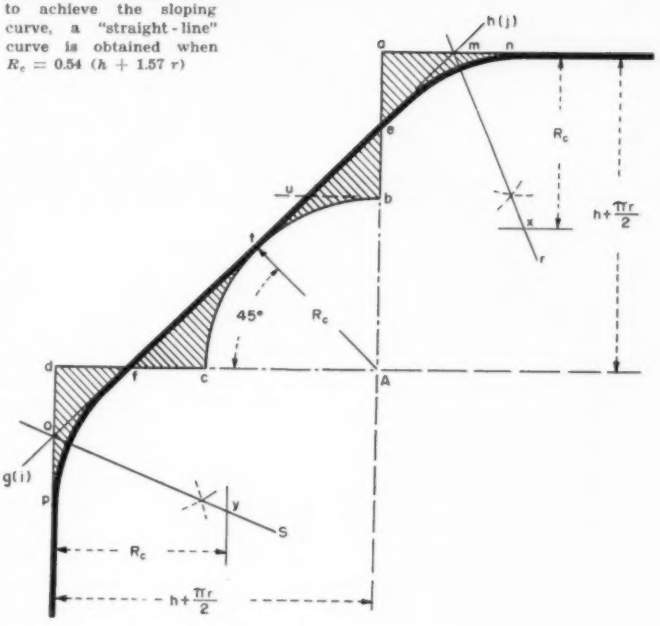


Fig. 7—In further refinement of the blank layout to achieve the sloping curve, a "straight-line" curve is obtained when $R_c = 0.54\ (h + 1.57\ r)$

5. In case the tangents, *gh* and *ij*, cross each other before they touch the quadrant arc, as shown in Fig. 9, an additional outside arc must be drawn for forming the sloping curve.

6. The necessary sloping curve is thus outlined by the arcs and tangent lines, as shown in Figs. 7, 8 and 9 by a heavy line.

The three types of the sloping curve at the corners of the blanks for seamless drawn rectangular shells, as shown in Figs. 7, 8 and 9, are determined by the height of the finished shell, by its bottom radius and by the calculated radius for the corner disk.

The "straight line" sloping curve, see Fig. 7, occurs when

$$R_c = Af \cos 45° = 0.707\ (Ac + cf)$$
$$= 0.707\ [Ac + \tfrac{1}{2}\ (Ad - Ac)]$$
$$= 0.707\ [\tfrac{1}{2}\ (Ad + Ac)]$$
$$= 0.353\left(h + \frac{\pi r}{2} + R_c\right)$$
$$= 0.353\ (h + 1.57\ r + 0.353\ R_c$$
$$0.647\ R_c = 0.353\ (h + 1.57\ r)$$
$$R_c = 0.54\ (h + 1.57\ r)$$

The "convex" sloping curve, see Fig. 8, occurs when:

$$R_c = Af' \cos 45°$$
$$= 0.707\ (Ac + cf + ff')$$
$$= 0.707\ [Ac + \tfrac{1}{2}\ (Ad - Ac) + ff']$$
$$= 0.707\ [\tfrac{1}{2}\ (Ad + Ac) + ff']$$
$$= 0.707\ [\tfrac{1}{2}\ (h + \frac{\pi r}{2} + R_c) + ff']$$
$$R_c > 0.353\ (h + 1.57\ r + R_c)$$
$$0.647\ R_c > 0.353\ (h + 1.57\ r)$$
$$R_c > 0.54\ (h + 1.57\ r)$$

The "concave" sloping curve, see Fig. 9, occurs when:

$$R_c = Af \cos 45°$$
$$= 0.707\ (R_c + cf')$$
$$0.293\ R_c = 0.707\ cf'$$
$$R_c = 2.4\ cf'$$

Since

$$cf' < cf$$
$$2.4\ cf' < 2.4\ cf$$

And

$$R_c < 2.4\ cf$$
$$cf = \tfrac{1}{2}\ (Ad - Ac)$$

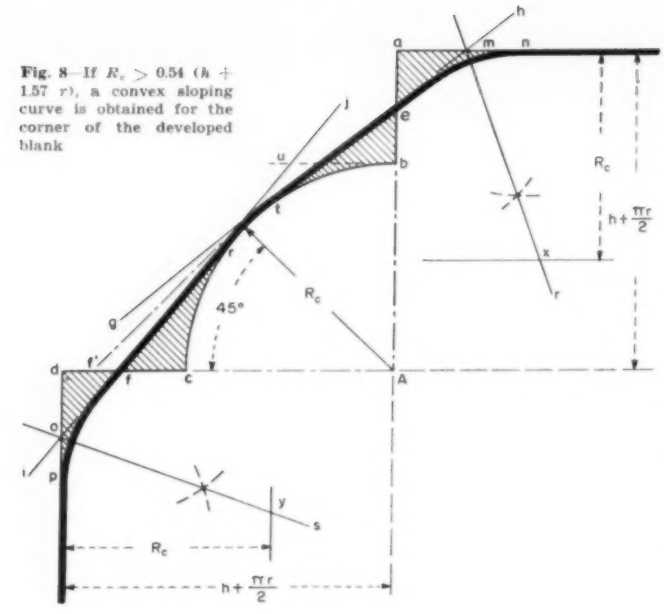


Fig. 8—If $R_c > 0.54\ (h + 1.57\ r)$, a convex sloping curve is obtained for the corner of the developed blank

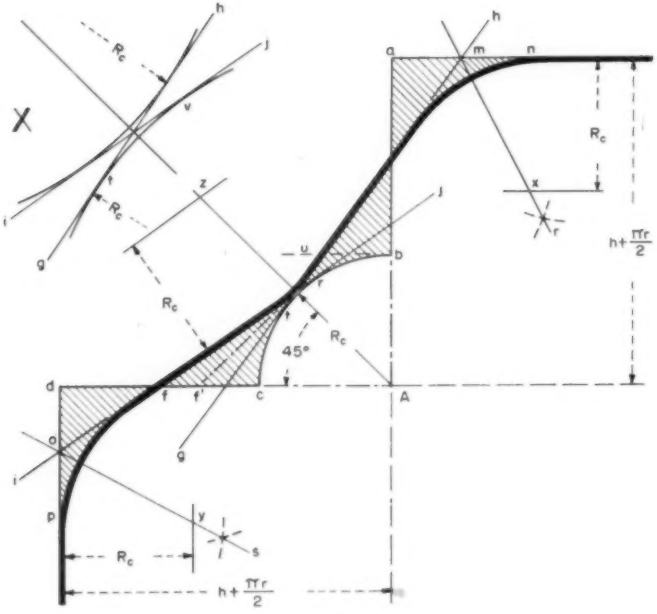


Fig. 9—When $R_c < 0.54\ (h + 1.57\ r)$, a concave sloping curve is produced and it is necessary to join the two main tangents smoothly

$$= \frac{1}{2}\left(h + \frac{\pi r}{2} - R_c\right)$$

$$= \frac{1}{2}\ (h + 1.57\ r - R_c)$$

$$R_c < 1.2\ (h + 1.57\ r) - 1.2\ R_c$$

$$2.2\ R_c < 1.2\ (h + 1.57\ r)$$

$$R_c < 0.54\ (h + 1.57\ r)$$

It can be shown now that the above drawn sloping curves for blank corners assure even distribution of metal because the areas of the shaded curvilinear triangles outside the sloping curves in the side walls of the blank are equal to the areas of similar triangles added to the quadrant arcs inside the sloping curve.

For this purpose, draw a line *bu* parallel to *an*. The triangles *ebu* and *eam* are equal, because they have equal angles *ueb* and *aem* as well as equal sides *ae* and *bc*. The curvilinear triangles *but* and *emn* are equal because they have equal angles *tub* and *emn*, equal sides *ub* and *em*, which sides with the other angle sides *tu* and *mn* are tangents to the arcs of the same radius.

Thus, the area of triangles

$$eam = ebu$$

$$emn = tbu$$

and, consequently, their sum, the triangles

$$ean = ebt$$

It must be noted that in the case of a "concave" sloping curve, Fig. 9, the triangles *ebt* and *frc* partially overlap each other. The tangent lines *gh* and *ij*, which cause this overlap, are also tangents to the outer arc which is a part of the sloping curve. The two curvilinear triangles formed by these tangents and the two arcs of the same radius, see Fig. 9 *X*, are equal. The addition of the upper triangle to the quadrant area under the sloping curve compensates exactly for this overlap.

The sloping curves, as drawn on Fig. 7, 8 and 9 thus assure that the areas (i.e. metal) taken off by these curves from the side walls are equal to those added to the corner quadrant arcs of the shell blanks.

Number of Draws

After finding the shape of the shell blank, the next step in drawing rectangular seamless shells is to determine the number of draws in which the shell can be made.

Since the actual drawing is done at the corners only, the assumptions used for finding the radius of the corner blank (disk) can be considered valid when determining

the general rules for drawing rectangular shells. Modifications apply, however, which come from actual practice in metal drawing.

In drawing cylindrical shells the diameter of the first operation shell (d_1) is usually:

For ferrous metals. . . . . $d_1 = 0.60\ D$
For non-ferrous metals . $d_1 = 0.50\ D$
Where D = blank diameter

In drawing rectangular seamless shells, actual practice discloses that the above figures can be halved, because of the flow of the metal during the drawing operation into the side walls of the shell where only bending is done. In terms of the radii of the shell corner in the first operation shell and of the corner disk, this can be expressed

For ferrous metals. . . . . $r_1 = 0.30\ R_c$
For non-ferrous metals . $r_1 = 0.25\ R_c$

The radius of the corner disk R_c, as shown previously, is determined by the height and by the corner and bottom radii of the shell. This permits deducing a relationship between the height and the corner radius which controls the possibility of drawing these shells in one operation.

We have found previously that:

$$R_c = \sqrt{2\,Rh + R^2 + 1.14\,Rr}$$

Substituting this value of R_c in the formulas for corner radii of the first-operation shells and making $r_1 = R$, we have:

For ferrous metals:

$$R = 0.30\,R_c \text{ or}$$
$$R_c = 3.33\,R$$
$$\sqrt{2\,Rh + R^2 + 1.14\,Rr} = 3.33\,R$$
$$2\,Rh + R^2 + 1.14\,Rr = 11.0889\,R^2$$
$$2\,h + R + 1.14\,r = 11.09\,R$$
$$2\,h + 1.14\,r = 10.09\,R$$
$$2\,h < 10.09\,R$$
$$h < 5\,R$$

For non-ferrous metals:

$$R = 0.25\,R_c$$
$$R_c = 4\,R$$
$$\sqrt{2\,Rh + R^2 + 1.14\,Rr} = 4\,R$$
$$2\,Rh + R^2 + 1.14\,Rr = 16\,R^2$$
$$2\,h + R + 1.14\,r = 16\,R$$
$$2\,h + 1.14\,r = 15\,R$$
$$2\,h < 15\,R$$
$$h < 7.5\,R$$

In other words, seamless rectangular cans can be drawn in depth in one operation from ferrous metals of ordinary drawing quality up to five times and from non-ferrous metals up to 7.5 times their corner radius. Thus, the larger the corner radius the better the assurance of making a rectangular shell economically in one drawing operation.

In cases of tall seamless rectangular shells with sharp (small radius) corners, several drawing operations are required for reaching the necessary shape of the shell from a flat blank. The average reductions in drawing seamless rectangular shells in terms of corner radii, are

For ferrous metals. . . . . $r_n = 0.40\ r_{n-1}$
For non-ferrous metals . . $r_n = 0.35\ r_{n-1}$

The above reduction figures in the corner radii of drawn shells control the number of the necessary draws. When the difference between consecutive draw radii is large, the use of a blankholder is advisable for preventing the formation of wrinkles or folds. When these differences are small, it is left to the stiffness of the metal to prevent such occurrences. Small juggling in the dimensions of the corner radii is permissible, because the given reduction figures are only averages.

The selected corner radii in the consecutive drawing dies, except for the final one, are drawn from the centers which assure a uniform width of metal around the punch, see Fig. 10.

The draw and bending radii and the clearances in the dies are generally made of the same size and shape as in circular drawing dies. Some die designers, however, strive to equalize the stresses in the metal at the corners with that at the sides by use of sharp bending radii in the lower die. This is done with the idea of preventing the shells from warping in annealing or enamel baking.

Flanged Shells

In conclusion, a few remarks should be added about drawing flanged rectangular shells and those made of heavy stock.

The general rules developed here for drawing straight-walled shells made of thin stock apply also to the two cases just mentioned, with the exception of the rules for finding the corner disk radius.

In the case of flanged shells (see Fig. 11 for the cylindrical shell, equivalent to all four corners in the rectangular shell) the area of the corner disk, as calculated for straight-walled shells, must be increased by the areas of:

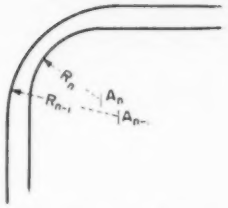


Fig. 10—Corner radii of punches for successive draws are shifted to different centers in order to assure uniform thickness of metal

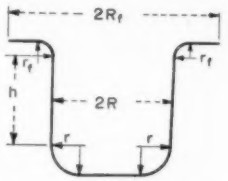


Fig. 11—If the seamless-drawn shell is to have a flange, the area of the flange and the area of the upper curved part must be added to the area of the corner disk as calculated for straight-walled shells

Upper curved part:

$$a_4 = \pi[\pi R r_f + (\pi - 2)\,r_f^2]$$

And flanged part:

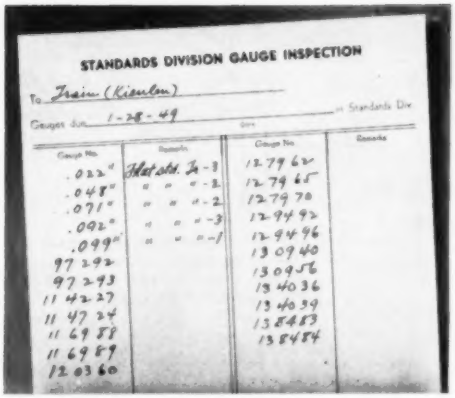
$$a_5 = \pi[R_f^2 - (R + r_f)^2]$$

With the area of the corner disk known, the finding of the corner disk radius is found in the same manner as in the case of straight-walled shells.

In the case of rectangular shells made of thick stock which elongates at the bottom corner and thickens towards the upper corner edge, it is impossible to define exactly the size of the corner disk. The suggested procedure is to find the cubic amount of metal (M) needed for the four shell corners, and to equate it to the amount of metal in a disk having the thickness (t) of the stock used.

$$\pi\ R_c^2\,t = M$$
$$R_c = \sqrt{\frac{M}{\pi t}}$$

The figure for corner disk radius is a close approximation, because in finding it the changes in the thickness of the stock during the drawing operation are not taken into consideration.



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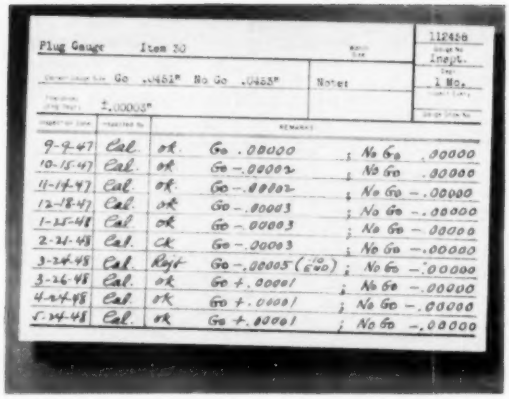
11 42 27		13 40 36	
11 47 24		13 40 39	
11 69 58		13 84 83	
11 69 59		13 84 84	
12 03 60			

Gage inspection requisition is written by clerk in Standards Division for each shop production department. Requisition lists gages to be returned on the following morning to Standards Division for check against master gages. Gages returned are checked against requisition and those not returned are noted on "delinquent" list that goes to department foreman and shop superintendent. Such lists seldom are needed as system has proved its value



Plug Gauge Item 30 112486

Go .4482" No Go .0483" Noted 1 Mo.

±.00003"

			REMARKS	
9-9-47	Cal.	OK	Go .00000	No Go .00000
10-15-47	Cal.	OK	Go -.00002	No Go .00000
11-17-47	Cal.	OK	Go -.00002	No Go -.00000
12-18-47	Cal.	OK	Go -.00003	No Go -.00000
1-25-48	Cal.	OK	Go -.00003	No Go -.00000
2-24-48	Cal.	OK	Go -.00003	No Go -.00000
3-24-48	Cal.	Rej+	Go -.00005 (.4480)	No Go -.00000
3-26-48	Cal.	OK	Go +.00001	No Go -.00000
4-24-48	Cal.	OK	Go +.00001	No Go -.00000
5-24-48	Cal.	OK	Go +.00001	No Go -.00000

Gage record cards are maintained for each of the 40,000 mechanical checking gages in the Elgin plant. First card, above, is held in the Standards Division files and contains actual gage measurements at each inspection date. Thus, gage inspector has record of wear rate on gage and can revise schedule of gage inspection if gage is wearing more or less rapidly than was originally anticipated. Second card travels with gage to shop after inspection and simply indicates that gage is satisfactory on inspection date

CONTROL SYSTEM INSURES GAGE ACCURACY

Plan includes inspection of all gages on predetermined schedule according to rate of wear in service

BY FRANK D. URIE,
Superintendent of Inspection
ELGIN NATIONAL WATCH CO.

More than 150 million precision watch parts are checked annually at the Elgin plant of the Elgin National Watch Co. As tolerances on most of these parts are ± 0.0002 in. or closer, work gages must be held to tolerances of ± 0.00003 in. or less. To maintain gages within these exacting requirements, Elgin operates a comprehensive system that recalls gages from production periodically, checks them against masters, and repairs or replaces those that are defective.

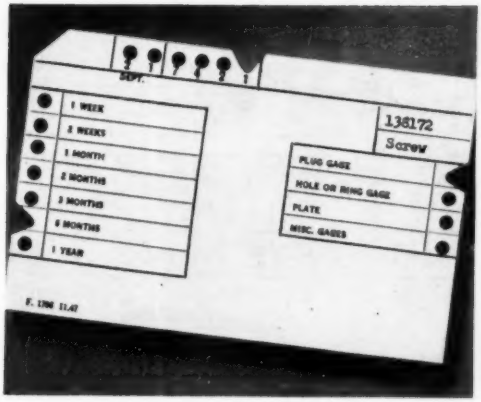
Included in the system are some 40,000 mechanical checking gages available in the plant. Because these gages wear with use, Elgin's inspection department a number of years ago concluded that each active gage must be checked against masters periodically, with the frequency of inspection determined by the rapidity of wear on the gage. Thus, for each gage, the Standards Division of the inspection department has on file a *gage record card* that shows when each gage was last checked against masters and the condition of the gage at that time. From this, the wear rate can be determined and an inspection period fixed.

Schedules Gage Inspection

To insure that each work gage is inspected according to the predetermined frequency, the Standards Division also has a second card index file for all mechanical gages in active use. These *call-up cards* are sorted according to the dates on which the gages are to be brought into the Standards Division for inspection. *Call-up cards* for gages to be inspected weekly, every two weeks, and monthly are filed according to the days of the month; cards for gages to be inspected every three months are filed in a separate drawer, also according to days of the month; cards for gages to be inspected every six months, or only once a year, go into another drawer with monthly tab cards. *Call-up cards* returned to these files after a gage has been inspected and accepted for reuse are filed behind the tab card for the date of the next inspection.

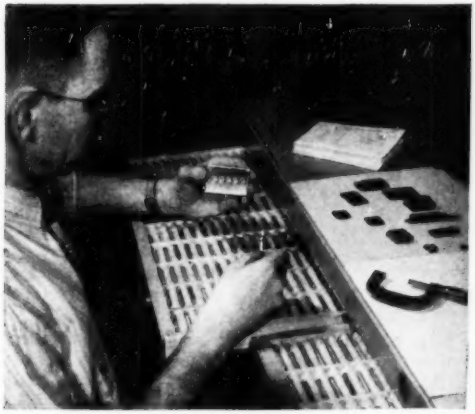
The system has been worked out so the Standards Division has a fairly even flow of work to prevent pile-ups that would keep gages off the production floor an unnecessary length of time. About 3,700 to 3,800 gages are checked against masters each month.

Each day the gage record clerk in the standards division draws *call-up cards* for gages scheduled to be inspected the next day. Gage

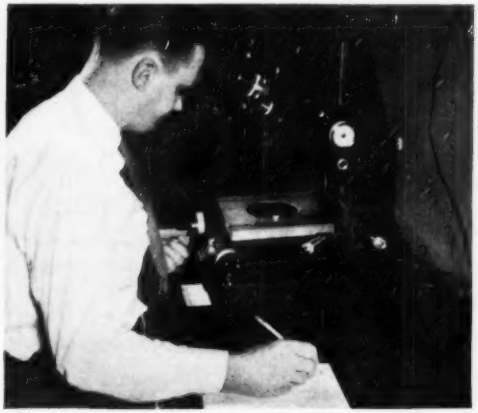


Call-up card is also prepared for each mechanical checking gage and is held in Standards Division files. Card carries gage number and name of department in which used and is punched on three sides. Thus, from total group, sorting pin quickly drops cards for given date, for given type of gage, and for given frequency of inspection. *Call-up cards*, filed by date on which gages are to be inspected, are sorted daily to obtain entries for *gage inspection requisitions*

Gage record clerk in Standards Division matches *gage record card* against *call-up card* and *gage inspection requisition* for tools returned by production departments. Gages and cards are delivered in small boxes to gage inspectors in Standards office. Cards are returned to file only after gages are approved and are ready for return to shop. If gage fails to pass inspection, clerk writes requisition for repair and makes entry in tickler file for follow-up on gage



Master inspection gages in Standards Division are used only for checking work gages used in the plant. All gages are protected carefully, as illustrated by felt-lined drawers provided for small pin gages. Inspector is checking plate containing five small work ring gages; hole gages on bench await check. Department has all necessary precision measuring instruments for adequate inspection of all gages in plant



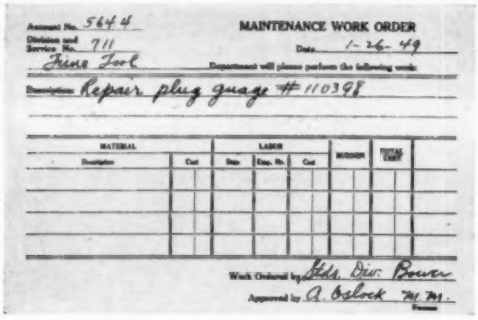
Master transfer plate for checking gage plates used in the inspection of watch parts is measured on Gaertner toolmaker's microscope by W. F. Bauer, Supervisor of Elgin's Gage Standards Division. Other extremely accurate inspection devices in the department include: Knoop hardness tester, Bausch & Lomb horizontal contour projector capable of enlargements up to 150X, and spring testers

numbers then are listed on a *gage inspection requisition*, the original of which is sent to the jobmaster in each work group.

The Jobmaster has these gages delivered to the Standards Division the following morning, drawing replacement gages from his tool crib and returning the shop file copy of the *gage record card*.

The record clerk in the Standards Division enters on a "delinquent" list all gages not returned by the shop. Gages returned according to requisition are matched with the record cards in the Standards Division. The gage with its three record cards is then delivered to a gage inspector. The condition of the gage is noted on the office copy of the gage record card, but on the shop copy of this same card the only notation is whether the gage is satisfactory for continued use. Next, the gage with all three cards is returned to the record clerk. Accepted gages are

Optical instruments and precision gage blocks are used in the Standards Division for checking master gages against which work gages are inspected. Inspector is checking diameters of very small plug gages against Johannson gage block. Instrument is a Zeiss Optimeter



MAINTENANCE WORK ORDER

Account No. 5644
Division and Service No. 711
Fine Tool
Date 1-26-49
Description Repair plug guage #110398

MATERIAL		LABOR			REMARKS	TOTAL COST
Description	Cost	Date	Emp. No.	Cost		

Work Ordered by Stds. Div. Bower
Approved by A. Oslock M. M.

Maintenance work order is prepared in duplicate when gage must be repaired or replaced. Gage then is sent to Fine Tool Department where necessary work is done. Corrected gages are returned to the Standards Division for checking and approval before delivery to shop

returned with their record cards to proper departmental tool cribs; the two office file cards are returned to the proper file drawers.

Gages rejected by the Standards Division inspector are sorted into a separate group by the record clerk, and requisitions for their repair or replacement are made out. These gages are sent to the Fine Tool Department where the necessary work is done. All gages repaired or replaced by the Fine Tool Department are returned to the Standards Division office for rechecking before they are delivered to the shop.

While this system has been worked out because of the close tolerances which must be maintained on parts made in the Elgin plant, it is applicable to other plants where tolerances are broader and frequency of gage inspection need not be as high. It has the advantage of assuring management that each gage in use is accurate within gage tolerances determined by the engineering and inspection departments and that each gage will be reinspected against standards as often as experience indicates it may have worn beyond control limits.

Unusual Gaging Practices

In addition to mechanical checking gages, many of the watch parts have made necessary the development of unusual gaging practices. For example, Elgin many years ago pioneered in the optical projection method for inspecting parts. Today special optical projectors providing magnifications of 30X to 100X are in use throughout the plant. Elgin, also, was one of the first to use precision gage blocks as master reference gages for all inspection equipment in the plant. A "AA" set of Johansson precision gage blocks serves as the master reference, while several sets of "A" quality Johansson gage blocks are employed in the gage standards department for routine gage inspection.

STANDARDS DIVISION GAUGE INSPECTION

To: Machine Dept. (Fine Tool)

Repair _____ following gauges for

Escape Dept.

#110398
Go (New plug)
No Go – OK

Jol ± .00003"

	Signed	Date
Sent to Machine Dept.	M. M.	1-26-49
Rec'd by Mach. Dept.		
Return to Standards Div.		

Maintenance follow form is made out in duplicate when *maintenance work order* is written. One copy goes to department to whom repair work is to be charged, second goes into follow file so Standards Division can make certain gage is returned for check after repair work has been completed

Inspection Procedures

Elgin's inspection department has full responsibility for the quality of Elgin watches. Incoming raw material is checked against carefully prepared specifications by representatives of the inspection department before the material is accepted and put into stock. Departmental inspectors in the production departments check work as it is being manufactured. Then, before any watch parts can be moved to the next department, they are sent to a central inspection room for final checking with precision gages.

Most parts must be checked 100% for dimensional accuracy, particularly parts for the small wrist watches. Some of the less critical parts are inspected under quality control sampling inspection procedures, using single sampling tables. But the extremely close tolerances required on many of the parts preclude the possibility of accepting finished parts according to sampling tables.

At all times chief departmental inspectors work closely with production supervisors and machine operators to help insure continued production of acceptable parts at the lowest possible cost.

How to Choose and Use

PORTABLE TOOLS

PART 6 . . . COMPRESSED-AIR SUPPLY AND COST

How to estimate the cost of compressed air and determine the size of compressor required for a portable-tool installation

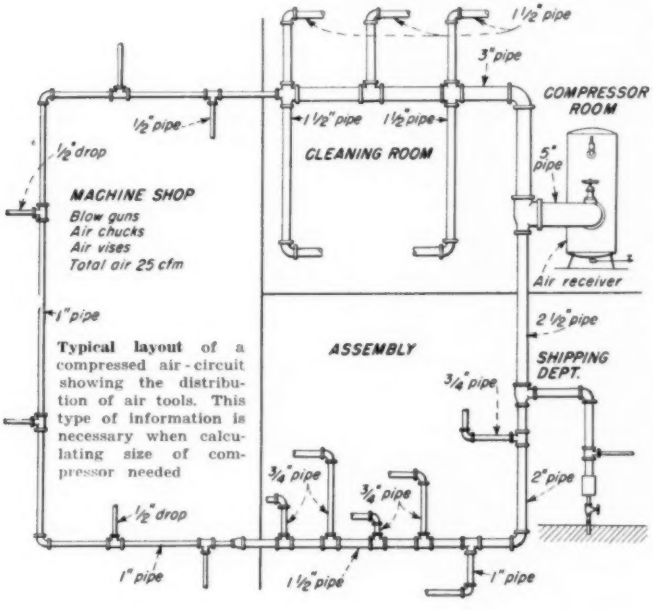
By H. P. BAILEY
President, THE ROTOR TOOL CO.

COMPRESSED-AIR tools necessarily require a source of power which will be adequate and reliable. If a compressor is already installed for other purposes it may be possible to use this to supply the tools, but consideration must be given to the load already imposed upon it by other requirements. Considerable care must be taken in determining the size of compressor required. The accompanying table shows how to proceed, and is based on an actual case history.

The column "CFM required while tool is operating," is obtained either by testing with a flowmeter and checking the average consumption during operation, or is taken from data supplied by the manufacturer. Portable tools when tested for maximum power may consume substantial amounts of air, but the cfm used to determine actual consumption is the consumption under average, ordinary operation in the shop. It will usually be found that this is considerably under the maximum consumption at maximum horsepower.

The next column "CFM required if tool is operating continuously" is the product of the number of tools times the air required per tool, and is based on the assumption that the tool is operated continuously 8 hr a day, 5 days a week. Total air required at the bottom of this column, 1,220 cu ft, is quite high and obviously does not present the true requirements.

However, checkup will show that a tool is seldom in operation 100% of the time, and the use factor will usually range from 10 to



Typical layout of a compressed air-circuit showing the distribution of air tools. This type of information is necessary when calculating size of compressor needed

TABLE FOR CLEANING ROOM

Tool	Air req'd cfm.	Use Factor %	Total actual air req'd cfm.
10 8-in. grinders	35	50	175
10 Chippers	30	50	150
2 Hoists	35	10	7

TABLE FOR ASSEMBLY

Tool	Air req'd per tool cfm.	Use Factor %	Total actual air req'd cfm.
20 Small screwdrivers	12	25	60
2 Large nut setters	30	25	15

TABLE FOR SHIPPING DEPT.

Tool	Air req'd per tool cfm.	Use Factor %	Total actual air req'd cfm.
1 Wood borer	30	25	7½
1 Screwdriver	30	25	7½
1 Hoist			8

HOW TO DETERMINE COMPRESSOR SIZE

Type Tool	Location	No. of Tools	CFM required while tool is operating	CFM required if tool operated continuously	% of time in day tool is operated	Air consumption = No. tools times CFM times %
Chippers	Cleaning	10	30	300	50	150
Hoist	Cleaning	2	35	70	10	7
Small screwdrivers	Assembly	20	12	240	25	60
Large nut setters	Assembly	2	30	60	25	15
8-in. Grinders	Cleaning	10	35	350	50	175
Hoist	Shipping	1	40	40	20	8
Wood borer	Shipping	1	30	30	25	7½
Screwdriver	Shipping	1	30	30	25	7½
Blow guns, chucks and vises	Machine Shop					25
TOTAL AIR				1,120		455

70%. A checkup in this particular case showed that the grinders were operating 50% of the time—the hoist only 10%. The figures therefore must be modified to show the actual average air consumption. For example, the ten 8-in. grinders require 350 cfm for continuous operation, but at 50% operation require only half of this, or 175 cfm. The final column, therefore, shows actual consumption, and results in a net requirement of 455 cfm. The blow guns, chucks and vises are listed arbitrarily at a total of 25 cfm, as this item is small, provided leaks are controlled. Quite possibly a manufacturer might be in error in providing only 455 cfm for this situation, as future requirements usually arise which require additional air. In this case a 500-cfm compressor was installed to provide some leeway. The installation was checked by determining the actual pressures delivered to the tools while under load, and proved quite satisfactory.

Actual checks of plant air capacity are likely to be somewhat incomplete, so less air is provided than is actually needed. Furthermore, leaks must be considered. If the compressor installation is left on for an hour or so after the close of the day and is continually loading and unloading, there is considerable leakage in the lines and valves, particularly at blow-guns. Leakage of air is surprisingly costly. A leak as small as 1/16-in. in dia will amount to 182,272 cu ft of air in one month, at an average cost of $10.94.* A series of such leaks obviously increases air costs, and particular attention should be given to air connections which are more or less out of sight.

Selection of compressor type is partly an engineering question, partly a practical one. Like other industrial equipment, if a compressor is purchased which has a high efficiency, that is, produces 5.3 cfm per bhp, the price will be higher than that of other compressors with lower efficiency. On the other hand, the power savings over the life of the compressor will be substantial.

Compressors must also be analyzed from the viewpoint of ultimate life, as some compressors are designed for high-speed operation and probably have less ultimate life than lower-speed types. Detailed consideration of horizontal, vertical, two-stage compressors, etc., is not relevant here, but it should be pointed out that two-stage compressors even in the 400- or 600-cfm range are decidedly more efficient than other types. Special types of unloaders may be obtained if there are long periods of reduced air consumption because of partial tool operation. It should also be pointed out that compressor bids often omit intercoolers and aftercoolers. An intercooler reduces the temperature of the air between stages and precipitates moisture. An aftercooler does the same to the air delivered from the compressor. The cost of an aftercooler in the range from 150- to 475-cfm capacity ranges from 18 to 13% of the compressor cost. On the larger duplex units, the percentage is relatively constant, at 8 to 7% over a range of 390 to 1050 cfm. The larger machines fall to 5%. This additional initial cost will be repaid many times in reduced maintenance of air-operated equipment over the years. It is rather difficult to figure the dollars-and-cents value of an aftercooler, but the elimination of moisture, with resulting better lubrication, reduction of rust forming in the lines, and general satisfaction, is undoubtedly a sound investment. Much of the maintenance expense with air tools can be traced to the lack of intercoolers and aftercoolers. In addition, with long lines, it is often desirable to install self-emptying traps to release any water condensed by a temperature drop as the air passes through the lines.

In considering compressor types, it is well to consider the different types of drive. The belt drive is, of course, economical under many conditions. Direct-connected, motor-driven compressors cost more but are more efficient and eliminate possible belt trouble. Steam-driven compressors, if the exhaust can be used elsewhere for heating or process operations, are often advantageous.

When additional air power-supply units are needed, the question arises whether to replace the central unit with a larger unit, or

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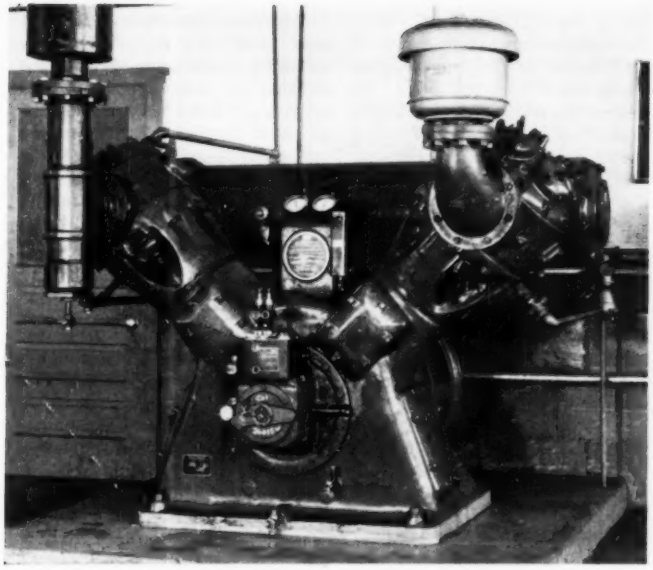
COST OF AIR LEAKS

Size of Opening, Inches	Cu. Ft. of Air wasted per mo. at 100 psi. based on nozzle coefficient of .65	Cost of Air Wasted per mo. based on 6¢ per 1,000 cu. ft.
3/8	6,671,890	$400.31
1/4	2,920,840	175.25
1/8	740,210	44.41
1/16	182,272	10.94
1/32	45,508	2.73



Two-stage V-type air compressor rated at 400 cfm. Intercooler is large cylinder at rear of machine. This is only one of the many types of compressor units available

to add a separate decentralized unit to take care of part of the plan.

The natural approach of a technically minded compressor engineer is usually to suggest replacement of the existing compressor with a larger and probably more efficient unit, using present distribution lines. A 2700-cfm compressor produces air for 3½¢ per cu ft at full load, while a 659-cfm compressor will produce it at a cost of 4.8¢ per cu ft.* Further study, however, will show that if the larger compressor is only used 50% of the time the cost has risen to 5.4¢. Often, main lines are scarcely able to carry additional air because of rust, etc., and there is often involved the cost of adding main lines or looping the lines. Distribution losses over substantial distances must also be reckoned. Yet it must be recognized that a central compressor plant installed with an adequate piping system makes the full capacity of the power-supply unit available to any part of the building at any time.

On the other side of this perennial argument are the advocates of decentralized compressors, who propose to put a 200- or 400-cfm unit into one department to take care of this situation. Very little piping is needed, there is no downtime, and the old large compressor does not have to be taken out and sold on the second-hand market and a new one installed. On the other hand, it must be pointed out that the smaller compressor is inherently less efficient. The cost of air with a 156-cfm compressor, for example, at full load jumps up to 7.2¢, and a careful study of probable length of life may show that the years of service to be expected from the smaller compressor is substantially less than from the big compressor. Many firms have installed decentralized compressors, then added units so that a plant may have several small, decentralized compressors all in a row, all pumping all the time, and obviously raising the cost of air substantially higher than if produced by a single, larger, centralized compressor. Probable overtime must also be considered, as one department may need a compressor for a second or third shift and management may not wish to operate the large compressor just for this one department. Occasionally, a combination of the centralized and decentralized systems seems to be the correct answer.

Instead of a single large compressor plant to accommodate all buildings, several installations may be made closer to load centers, with the several compressor stations interconnected so it is practical to supply air from any one, two or more stations to any part of any building in the system. If each station has a total capacity somewhat in excess of the normal needs of the area served, it is then possible to supply air to other buildings or areas for work over weekends or if one center is completely shut down for servicing. This broad approach to the problem may be given even more flexibility by having each main center served by two or three fairly large compressors rather than one single compressor.

Marginal Use of Air

Often compressed air is used as a power source for so many different purposes, where air is the only source of power for sandblasts, paint sprays, etc., that the actual amount of air used for portable-tool operations becomes simply an extra amount to be added to the power supply provided.

A company may be using air for operating certain types of forge hammers, for sandblasting, molding, etc., and the air required for these purposes is 500 cfm. The average air needed for the portable-tool operations is 160 cfm. There is hardly any recognized or standard way of figuring this situation, but many firms feel that 600 cfm of air must be provided anyhow, and carry the base cost of compressing air on the basis of 600 cfm. Thus the extra 160 cfm becomes "marginal air," therefore actually costs them a smaller amount. This is because a 659-cfm compressor operated at 75% of load results in a net air cost of 5.9¢

* Compressed Air Handbook. Copyright 1947 by Compressed Air and Gas Institute

per 1000 cu ft, while if additional air for portable tools brings the load up to 100% operation the cost becomes 4.8¢ per 1000 cu ft. In other words, if full-load operation costs $418 a month, 75% operation costs $385 or an additional amount of only $33 to provide 25% of 659, or 165 cu ft, which means that the extra air is costing under this combination of circumstances 2.36¢ per 1000 cu ft. It must be realized that this situation exists only occasionally, but wherever full capacity of the compressor is not needed, certainly the extra air costs about half of the existing cost.

The same comparison applies to stepping up the size of the compressor, as the cost of air promptly goes down as the size of the compressor becomes larger and the installation becomes inherently more efficient. It must be remembered, however, that at the time a compressor is installed it will be operating for a long period, 20 to 25 years, and that an engineering analysis of the cost factors will be well worth while because the savings will be repeated over a long term. On the other hand, attempts to analyze the situation too critically are likely to fall far short of the mark because of the general trend of expansion of American industry. This means that in the majority of cases the original compressor becomes too small for the load required by the expanding volume of the plant or the enlarged use of compressed air as a source of power.

Power Costs

Calculation of power costs in delivering air in various quantities in various load factors is somewhat complicated, so the accompanying table* is worth careful study.

The cost of producing air at full load with a 156-cfm compressor is 7.18¢ per 1000 cu ft. With a 659-cfm compressor this cost drops to 4.8¢, and with a 2700-cfm compressor it drops to 3.45¢, showing that the cost of air drops as the quantity produced increases.

The next item is the variation in the cost of air due to load factor. Taking the illustration of a 659-cfm compressor, the cost is 4.8¢ at full load, but at 75% the cost rises to 5.9¢ and at 50% to 7.6¢.

After all computations are made, analysis of labor costs will show that the power costs for operating tools are very small indeed. It is true that these power costs multiplied over a term of years are a large item, but so is the labor item, and it appears that often too much emphasis is placed on the relative power costs of universal, air, 180- or 360-cycle tools.

The following figures* cover the cost of air for operating various pneumatic tools, based on 1947 costs. Heavy-duty chipping hammer 3½¢ per hour, heavy-duty air drill, 2½¢ per hour, heavy-duty 8-in. grinder, 5½¢ per hour.

Production of Air Tools

Because of the variety of operations and conditions in different metalworking plants, it becomes very difficult to generalize and make specific recommendations as to which type of power-supply unit should be provided for the portable-tool equipment from the viewpoint of production output. Certain types of tools, such as scalers, sand rammers, chipping hammers, etc., are not practical under any form of power except air, and the reciprocating action of chipping hammers, for example, is hardly approached by any other form of tool.

From the production viewpoint, however, the basic principle emerges that the more power supplied per pound of weight the greater the productivity, and therefore the power per pound becomes a vital factor.

Air tools rank with 360-cycle tools as giving the highest horsepower per pound. Conversely, air and 360-cycle tools are usually the lowest in weight for a given operation. Air tools are generally regarded as probably the cheapest of the four forms from the maintenance viewpoint.

At this point another problem enters, showing how difficult it is to make general statements about all styles and types of tools. For example, in the die grinder field, factory executives recognize that very small, air die-grinders are definitely superior to other types because of the combination of power, speed and weight. The die-grinders supplied by 180- or even 360-cycle power are relatively heavy, and universal tools are definitely too heavy. The importance of size in the handling of these small tools often causes factory executives equipped with one particular type of power supply to supplement this group with air tools in the die-grinder field. Another situation in the case of air tools is that the original power of the tool no doubt drops with wear and age. Since the tool is designed with an excess of power for first use, this does not become apparent for some little time, but there is no doubt that air tools tend to drop down in power over the years, even with good maintenance.

The practical answer in the final decision as to which type of tool is most productive is to test out the different types of tools on the job, developing actual time figures showing operation costs or, in the case of grinding, getting metal removal tests on the particular work to be done. Such tests give a clearer, keener view of the situation and will show up even small differences in the work output of different types of tools.

General Principles

A few general principles, may be summarized, based on analyzing a substantial number of situations over a period of years.

1. To determine the proper type of power supply, air, universal electric, 180- or 360-cycle, analysis should be made of the portable tool needs of the shop, computing the amount of power required for the different types, the size of power-supply unit required, and the power costs. The final summary of these figures should not give too much emphasis to the one element of power costs, but first and predominant emphasis should be made on the actual productivity of the different types of tools on the particular operations.

2. Where present power-supply

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units are overloaded, or where additional plant facilities are badly needed, consideration may well be given to the use of 180- or 360-cycle to reduce the investment cost of the additional power supply to be purchased, considering the problem from the viewpoint of the individual tools and their productivity, as well as the over-all dollars-and-cents picture. Where additional departments are planned, or additional plants are to be provided, factory executives have more scope in their decisions and are not limited by characteristics of existing situations.

Here, a very thorough study is indicated in view of the competitive conditions now beginning to appear, and the over-all cost of the additional portable-tool facilities, including power-supply units, becomes an important item. It will be found that the cost of providing power-supply units for the 180- and 360-cycle tools will run about one-third that of supplying the air compressor power-supply unit, with the tool equipment costing roughly about the same. Experience shows that this is an important factor and that many 180- and 360-cycle installations are put in because of the savings in dollar cost to provide the facilities for the portable-tool operation. Sometimes both 180- and 360-cycle are installed, and then compressors are installed for other operations or for part of the portable tool operations, but the investment savings are large in the case of the 180- or 360-cycle.

When management has to decide whether to install more air tools for a job that requires additional equipment, or whether to switch to 180- or 360-cycle tools, a careful appraisal of all the factors involved should be made before final decision is made. No one tool has all the advantages.

A typical example may shed light on this subject: A user was installing 25 grinders in a new department. These consisted of 6-in. straight-type grinders, as well as cup-wheel grinders, cone grinders and small wheel grinders.

An analysis of the power required to operate 25 air grinders on a conservative use factor of operation showed that a 110-bhp two-stage compressor would be required.

Against this, 25 high-cycle grinders of equivalent size could be operated from a frequency converter having a 30-hp motor. While power costs are not the deciding factor in tool operation, nevertheless, such a substantial power saving cannot be overlooked.

More important perhaps is the saving in first cost of the frequency converter compared to a compressor to operate the corresponding number of air tools. In this particular case, the converter costs about $1725, and since the tools cost about the same whether they are air or 180-cycle, it was incumbent upon management to make the decision whether the savings (which were substantial compared to the compressor) justified a separate high-cycle installation for the grinding operation, since air was also required in the same department for other operations which could not be done by any other type of power.

In addition to these savings, of course, there should be taken into consideration relative work output of the air compared to the 180- or 360-cycle grinders, and this can be easily determined from trial runs in the plant under regular operating conditions.

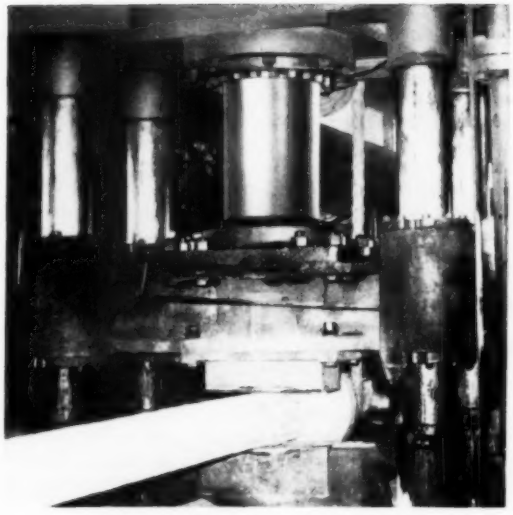
The major reason for the substantial purchases of portable tools in the last two years is, of course, the competitive cost situation and the likelihood of still lower margins in the future, combined with the demonstrated possibilities for rather substantial savings with modern equipment. Where savings warrant scrappings of existing tools or relegating them to maintenance work, the old tools should be scrapped, and new ones bought to be paid for rapidly out of the actual practical savings. *(Part VII of this series will appear in a forthcoming issue—Ed.)*

CALCULATED COST OF COMPRESSED AIR 100-LB PRESSURE

Unit	A			B			C		
Motor Size	40			125			500		
Actual Cap. C.F.M—Full Load	156			659			2,700		
Operating Hrs./Month	220			220			220		
Initial Investment									
Equipment Cost	$2,152			$8,932			$25,252		
Installation Cost	244			1,118			5,675		
Total Installed Cost	$2,396			$10,050			$30,927		
Monthly Charges									
Fixed Charges and Repairs	$23.00			$50.25			$154.64		
Lubrication	1.15			1.07			4.29		
Attendance	27.50			55.00			55.00		
Cooling Water	.....			30.50			106.80		
Total Charges, Less Power	$51.65			$136.82			$320.73		
Power Calculations									
Load Factor	100%	75%	50%	100%	75%	50%	100%	75%	50%
Total Air in Thousands cu. ft./month	2,060	1,545	1,030	8,700	6,525	4,350	35,640	26,730	17,820
KW hrs./month	6,380	5,236	4,092	21,868	17,116	12,386	85,690	66,792	48,356
Ratio: Compressor KW hrs. to Total Plant KW hrs.	⅛	⅛	⅛	⅛	⅛	⅛	⅛	⅛	⅛
Total Plant KW hrs.	51,040	41,888	32,736	174,944	136,928	99,088	685,520	534,336	386,848
KW Max. Demand—Compressor only	29	29	29	99	99	78	390	390	303
Total Plant Energy Cost	$538	$458	$376	$1,456	$1,190	$924	$4,159	$3,402	$2,664
Compressed Air Costs									
Energy @ ⅛ Plant Total	$67	$57	$47	$182	$149	$116	$520	$425	$333
Compressor Demand Charge	29	29	29	99	99	78	390	390	303
Fixed Charges	52	52	52	137	137	137	321	321	321
Total Air Cost/Month	148	138	128	418	385	331	1,231	1,136	957
Cost of Air/1000 cu. ft.	$.0718	$.0893	$.1241	$.048	$.059	$.076	$.0345	$.0425	$.0536

HOW TO SELECT SPRAYED METALS

Cost-saving applications lie waiting for manufacturers who know how each metal behaves and what it's good for. Here are the answers — from many years of experience and research



PRESS RAM HAS SPRAYED COATING OF STAINLESS STEEL

BY JOHN E. WAKEFIELD
Metallizing Engineering Company

MORE and more companies are using sprayed metal in their new machinery. Machine tools, turbines, pumps—to mention only a few—have parts subject to wear or corrosion or both. It's often more economical to build spindles, shafts, rods, and the like from low-cost, easily machined steel and to protect critical sections with better metal. Spraying is a fast and practical method for adding metal where it's wanted (*AM*—May 19 '49 p107-118).

In selecting jobs for sprayed metal, builders should understand two very important points. First, sprayed metals are entirely distinct and separate engineering materials. They are made up of tiny, flattened particles of pure metal, surrounded by very thin films of oxide, and contain microscopic voids throughout. Porous to a certain degree, sprayed metals have 10 to 15% lower specific gravity, reduced tensile strength, low elongation, high compressive strength, and very high particle hardness. Recognition of these differences between sprayed and other forms of metals is the most important step toward understanding the uses of sprayed coatings.

The second step is to gain the proper concept of their purpose. Sprayed metals are applied purely as a surface treatment of other materials to provide better wear or corrosion resistance or both. Hence, lubricating qualities, hardness, wear resistance, machinability, and corrosion resistance govern selection for different applications. Before examining individual metals, consider those characteristics common to all sprayed metals:

Common Characteristics

Lubrication—The most favorable quality of sprayed metals is their ability to absorb and hold oil. It has been proved both in practice and in the laboratory that they will absorb from 5 to 10% (by bulk) of oil.

In one series of tests, sprayed steel shafts running in white metal bearings were compared with hardened steel shafts operating under the same conditions. Tests were made with plain oil and graphited oil at 27, 261, and 445 sfpm with loads varying from 200 to 2000 psi. At all speeds and loads, except below 400 psi at 261 fpm sprayed metal ran with less friction.

In another test, the oil supply was intentionally cut off. Hardened steel surfaces seized in an average of 3½ hr, while the sprayed metal journals averaged 22½ hr before freezing. When freed, the sprayed steel ran for several more hours before seizing again.

Hardness—The wide difference between sprayed and other metals shows up clearly in hardness tests. Because sprayed metals are porous, tests that depend on penetration do not give an accurate indication of wear resistance. For example, 0.80 carbon steel after spraying gives a reading of 30 to 32 R_c (Rockwell, C scale). Yet, in practice, this metal outwears materials of 50 to 55 R_c. Why?

Part of the answer is provided by micro-hardness tests. These reveal that individual particles of sprayed 0.80 carbon steel run from 55 to 60 R_c. Thus, sprayed metals, like powdered metals, are made up of very hard particles within a relatively soft structure. Hardness is further increased by the chilling effect during spraying, and, with carbon steels, by additional carbon picked up in the operation.

Wear Resistance — The excellent wear resistance of sprayed metals is accounted for by the combina-

tion of particle hardness and reduced friction. One factor which has some effect goes back again to porosity. Surface pores in sprayed coatings provide an escape for the tiny metallic particles that are always dislodged in the wearing process on lubricated surfaces. This again tends to reduce friction and make for longer wear.

In actual service, there have been many reports of sprayed metals outwearing the same metals in ordinary form. In a study of crankshafts, wear proved to be 15 to 50% less on sprayed shafts than on hardened ones. Some of the crankshafts operated in private cars, others in gasoline and diesel trucks and buses. One crankshaft in a gasoline engine on a long-distance bus, seized in service because of failure of the oil pump. Careful examination showed that bearings in contact with the plain journals had all scored and run badly: those in contact with sprayed journals were still in perfect condition.

Shrink—Another important factor to be considered in sprayed metals is their shrink characteristics. Metal spraying seldom heats the work or the coating above 150 F where light coatings, 0.025 in. and under, are applied. Heavy coatings, 0.100 in. and over, sometimes reach 300 F, and on these coatings, high-shrink materials must not be used. But there is no limit on coating thickness if a low-shrink metal is applied (see tabulation).

Of course, the disadvantage in the lower shrink metals is that they have to be ground because of their hardness. If grinding facilities are not available, yet heavy coatings are needed, it is quite practical to apply a hard, low-shrink metal to within 0.030 in. of the finished size and to complete the coating with a machinable steel such as 0.10 carbon.

Card feel roll for textile machinery operates under conditions in which lubrication is critical. Spraying with 0.80 carbon steel greatly increases service life

Another important point if heavy coatings are needed is the method of preparation. The strongest method should be used, and this is generally considered to be a combination of threading and special knurling (*AM*—May 19 '49, p113). Threads in the base interrupt any shrink which might occur and help prevent any tendency to crack.

So much for characteristics common to almost all sprayed metals. Now consider what metals are available and what their individual characteristics are.

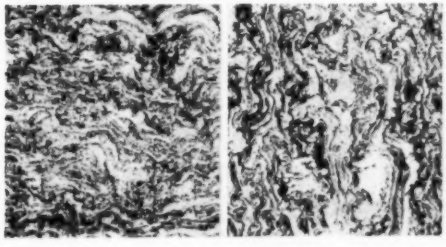
Individual Metals

Steels—Most commonly applied for metallizing is 0.10 carbon steel. It sprays well, is a little harder after spraying because of additional carbon picked up during the operation and is readily machinable with ordinary tools. Coatings have a tensile strength of around 30,000 psi. Sprayed 0.10 carbon wears longer than 0.10 carbon bar stock, because of its greater hardness and better oil-holding properties. Its greatest disadvantage is its high shrink, which causes a tendency to crack in coatings more than 0.100 in. thick.

0.25 carbon steel is selected where a harder surface is desired, but one that is still machinable. It sprays well and picks up some carbon. Coatings can be machined with ordinary tools, but a better finish can be obtained with cemented carbide toolbits. Its tensile strength is almost 35,000 psi, and it has less tendency to crack, as its shrink rate is lower.

0.80 carbon steel is for still harder surfaces. It wears very well, lubricates well, and has a tensile strength of about 27,000 psi. Low shrink makes it excellent for heavy coatings and its compressive strength is very high. Sprayed 0.80 coatings should be ground, preferably wet. Finish with cemented carbide tools is only fair.

The best-wearing steel available is medium-chrome, medium-carbon stainless. For that reason, it



Oxide-to-metal bonding is the major factor in holding sprayed particles together. Physical interlock and some welding also occurs. Photomicrographs are of 0.25 carbon steel, 100X. That at left is section across sprayed coating; other is section along coating

is grouped with the steels rather than stainless, although its corrosion resistance is good enough for all mild to fairly severe conditions. This steel has a tensile strength of 40,000 psi, is hard and tough, and is highly recommended in all cases where severe wear and abrasion occur on bearing surfaces, packing gland zones, and roll faces. Because of its low shrink this material can be applied safely to almost any thickness.

Copper and Bronzes—Copper of high purity sprays fairly rapidly and can be machined easily. It has many electrical uses, but few in the mechanical field, except for roll surfaces.

Five types of bronze are available, but only two are used to any great extent. The best is an aluminum-iron bronze developed especially for metallizing. It has high tensile strength, is hard, wears almost as well as cast iron, and can be machined to high finish with almost any kind of tool. Corrosion resistance of this material is good.

The other is a Tobin bronze, which has been sprayed on impeller hubs, diffuser castings, packing sleeves, plungers, and other parts. Coatings are quite porous, but machine well with cemented carbide tools.

Nickel and Nickel Alloys—Pure nickel sprays fairly well, but is difficult to finish except by grinding. Much more widely applied is monel. This metal sprays well, produces a good coating, and has high resistance to corrosion. For good machine finishes, coolants are required.

Monel is porous and for best results in service where corrosion is severe should be sealed. This is done by painting or dipping in raw tung oil, or raw or boiled linseed oil, mixed with 5% by volume of cobalt liquid drier. Painting or dipping should be done while the part is still warm, but not hot, after spraying.

18-8 stainless steel is a good material for many corrosion problems. It sprays fairly well, but has a comparatively high shrink. The metal should not be used where severe wear is encountered. Coatings are porous but can be sealed by the same method described for monel.

COMPARATIVE SHRINK RATE OF SPRAYED METALS

METAL	SHRINK, IN.
Iron	0.009
10 Carbon Steel	0.008
25 Carbon Steel	0.006
80 Carbon Steel	0.0014
18-8 Stainless Steel	0.012
Tobin Type Bronze	0.010
Chrome-Carbon Steel	0.0018

Applications

Packing Surfaces—Packing sections on steam turbines are already being metallized by two principal manufacturers. In 1941, Westinghouse advertised turbines with shaft packing-gland zones sprayed with high chrome-nickel steel. The advantages of this application are obvious. Only the two gland zones are subject to corrosion and pitting. It is much more practical to make these shafts out of easily machined metal and protect the critical sections with superior metal. Shafts are less expensive in both materials and machine time, and are entirely satisfactory.

General Electric Company, on the other hand, prefers sprayed monel. From a metallizing point of view, there is little to choose. Both spray well, can be given a high finish, and will withstand corrosion and wear.

Pump manufacturers can take a leaf from the books of these outstanding companies. Centrifugal pump packing areas are subject to similar conditions of wear and corrosion. Quality can be maintained at a much lower cost.

A case in point is the following repair operation: Bronze packing sleeves 4 in. in diameter by 14 in. long for a circulating pump were quoted at $44 each, and new stainless steel sleeves at $169 each. Cost of metallizing the worn bronze sleeves with medium-chrome, medium-carbon stainless steel amounted to less than $8 per sleeve. The sprayed sleeves not only outlasted the bronze ones by more than 4 to 1, but considerable packing was saved as well.

Packing problems are not confined to rotating parts. Manufacturers of hydraulic presses can find an answer to one of their problems in the metallizing process. Builders sometimes use or recommend chrome plate as a protection for rams. Yet, chrome plating is slow and very expensive. And unless a heavy plate is applied, there isn't body enough in the coating to stand much service. The author has seen rams with the chrome-plated surface pushed back into the cast-iron body in long, clearly marked scores. Packing no longer could be kept tight. It is much faster and less expensive to add a $\frac{1}{8}$-in. coating of sprayed stainless steel. More important still, such a coating, while not as hard as chrome plate, has body enough to stand the action.

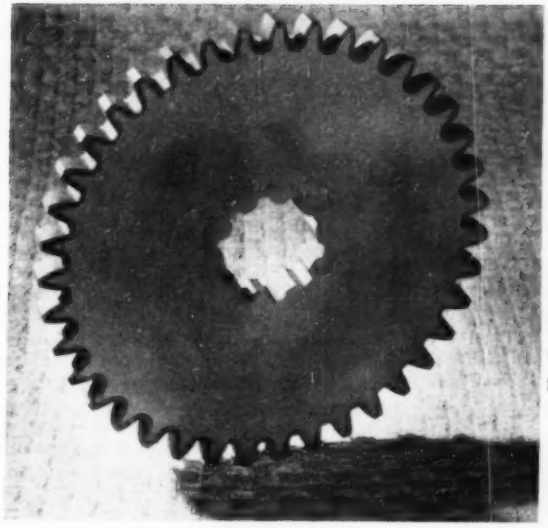
Bearing Surfaces—In machinery with bearing surfaces that must stand severe wear, or where lubrication is critical, sprayed steels offer a real improvement. For example, in the textile industry, where lurication is a problem, sprayed 0.80 carbon steel has increased part life many times over.

Roll Surfaces—One of the outstanding applications for metallizing is the manufacture of rolls, large and small. Rolls are usually subject to corrosion. Very often, they are subject to wear or abrasion too, either from the material which passes over them, or from doctor blades or scrapers. Roll surfaces often pit or wear unevenly and have to be reground to true. Eventually, they become too small for further bearing adjustment.

Here, metallizing offers the possibility of great savings. Many rolls have been made of iron pipe, with ends plugged and journals fitted in.

One manufacturer reported the cost of rolls made of iron pipe and sprayed with stainless steel at less than 50% of the cost of rolls made of stainless steel tubing. Service life was equal in every respect.

Conclusions—Work of the kind described is being done regularly by users of metallizing equipment. More and more, other manufacturers will find in sprayed metals the answer to better protection against wear and corrosion at lower cost.



An induction contour-hardened gear

HOW TO

Heat-Treat Spur Gears By Induction Heating

BY J. A. REDMOND
Engineering Department,
Electronics & X-Ray Division
WESTINGHOUSE ELECTRIC CORPORATION

"ONE-at-a-time" heat-treatment of gears is desirable, even in quantity production, because of the high loss in machining time and material if batch spoilage occurs. But familiar processes require large equipment and batch treatment. High-frequency induction heating has long been recognized as a potential solution, but early results were disappointing. The author here describes, however, induction heat-treating processes used successfully in high production of a number of types of spur gears. Equipment, procedure and metallurgical results are included.

Handling and work-in-process are cut, changeover is easy, quenching fixtures are unnecessary, distortion is reduced and delays are avoided.

A SPECIAL American Machinist REPORT TO THE METALWORKING INDUSTRIES

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Induction Method Depends on Gear Size and Service

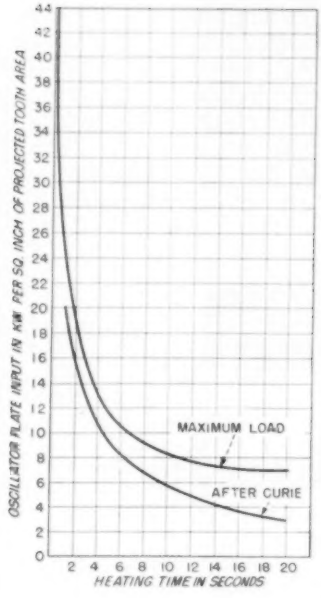


Fig. 1—Time-power relations for through-hardening 14-DP gears at 450 kc to a depth of 0.020 to 0.030 in. below the root radius. One curve represents max. load on the generator, the other load after the steel has reached Curie temperature. Total heating time can be shortened by increasing current through the coil after the steel reaches Curie temperature. On 14-DP gears, power input density can be 18 kw (oscillator plate) per sq in. of projected tooth area without burning tips, but 8-DP gears must be heated with less than 4 kw per sq in.

ONE OF the first applications of induction heat-treatment was on tractor bull gears of 2.5 DP. For large gears of this type, the entire rim is induction heated to the correct temperature for hardening by power at a frequency of 3,000 or 10,000 cycles per sec. After soaking at this temperature, the gear is quenched. This produces a high hardness at tooth surfaces, while cores are relatively soft, if a steel with the correct hardenability is selected. The method is suitable only where teeth are large enough to prevent tooth centers from hardening when the teeth are through-heated.

Two other ways of induction hardening are now in use for smaller gears. One method is to through-harden the teeth by induction at a relatively low power density; the other is to contour, or surface-harden, the teeth by a relatively high power density. Each method, when properly applied, can produce production economies and sometimes will result in an improved product as well.

Through-Hardening of Gears

IF GEARS are heated with a relatively low power density (low kilowatts per unit area), the teeth will be through-heated. If these gears are quenched from above the hardening temperature, the teeth will be through-hardened, unless they are of such a size that the hardenability of the steel prevents hardening the core of the teeth. A short heating time will result in hardening the tips; longer heating time will result in hardening the entire tooth to below the root radius.

To through-harden the teeth, power densities must be kept low enough to prevent overheating tooth tips. On the other hand, the power density must be high enough to heat the teeth and rim without heating too deeply. If heating is too deep, heating time will be higher than necessary, quenching will be more difficult, and there will be more tendency towards distortion.

Applications of through-hardening are found where the load on the gear is not great and where a compromise between surface hardness and strength can be tolerated. The method is particularly suitable for gears with small teeth, in the order of 14 DP, where a relatively high power density and short heating time may be used, Fig. 1.

Another extensive application involves hardening of automobile-flywheel ring gears, Figs. 2 & 3. These gears are not subjected to large loads but must withstand the wear and clashing of the starter pinion.

Fig. 2—Sections of a 14-pitch transmission ring gear with 5-in. ID and 1-in. face through-hardened at 450 kc per sec. It is NE-8640 steel with Cr 0.7%, Ni 0.6% and Mo 0.25%. Induction heating reduced distortion and permitted hardening in oil without quenching fixtures. Max. temperature reached at a point ⅜ in. from tooth tips was 400 F. Heating time was 12 sec with rf generator plate input of 200 kw

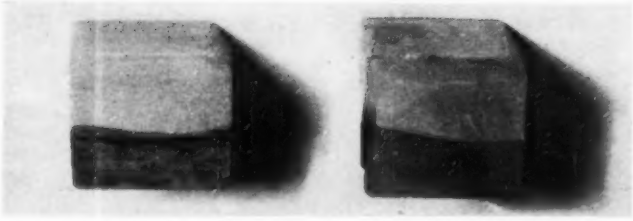


Fig. 3—If only clashing surfaces of a ring gear are hardened, time is 7 sec with a 50-kw rf generator. These are etched sections from a ring gear (C 0.55% and Mn 1.0%) in which the entire tooth was hardened, requiring 8 sec with a 50-kw unit. Power density was about 4-kw oscillator-plate input per sq in. of projected tooth area. To reduce voltage between gear and coil to half work coil voltage, coil electrical center is brush-connected to gear center

In most ring-gear applications, it is necessary to harden more of the tooth than just the clashing surface.

Through-hardened gears with small teeth may be obtained with either a radio-frequency generator at a frequency of 450 kc per sec, or with a motor-generator set with an output frequency of 10,000 cycles per sec or less. Through-hardening of large gears, such as tractor bull gears, is best done with a motor-generator set at one of the lower frequencies because of the relatively deep band that is heated at these frequencies. Small gears, where it is desirable to restrict the heating to a relatively narrow band, should be heated with higher frequencies. Medium-size tractor bull gears are often through-hardened with 10,000-cycle power to below the roots.

Contour Hardening of Gears

IF through-hardened teeth are required for heavy loads and hard service, they must be large. Some sacrifice in wearing qualities must be made in order to have sufficient strength in the tooth. Because of this, a carburized gear is generally used.

A carburized gear has a hard surface, generally 0.020 to 0.040 in. deep, backed by a relatively soft ductile core. This gives the surface good wearing quality and still enables the tooth to withstand the shock of heavy loads. It was with these qualities in mind that the present system of contour hardening with radio frequency was developed.

To obtain a good contour-hardened gear by induction heating, it is necessary to bring a surface layer of required depth to a temperature above the hardening temperature, then quench it rapidly. If this can be done, the gear will resemble a carburized gear in that the surface will be hard and the core of the tooth will be relatively soft and ductile. To accomplish this, the high-frequency currents must flow in a uniform layer over the tooth surface. Heating time must be short. A short heating time requires a high power density.

From a metallurgical standpoint, heating time must not be too short. A minimum time, at high temperature, is required for complete formation of austenite, which is a function of the steel used, its pre-treatment and the temperature to which the steel is raised. In most induction-heating applications, temperatures reached are higher than those employed in furnace heat-treating a given steel, and the time for formation of austenite is correspondingly shorter. Higher temperatures can be tolerated because heating times are short and there is not so much tendency for grain growth or for formation of scale.

Formation of Stria

WHEN a gear is first heated with high frequency, the current flows in a fairly uniform layer over the tooth surface. As soon as a region of the tooth surface reaches the Curie temperature, it becomes non-magnetic. Non-magnetic regions of the tooth surface offer a lower impedance to flow of high-frequency currents than magnetic regions. Due to this "skin effect," non-magnetic regions of the surface rob current from magnetic regions. Magnetic regions then tend to cool off because of reduction in current density, while non-magnetic regions get hotter because of increased current density. The result is an unstable condition on the surface of the tooth, with

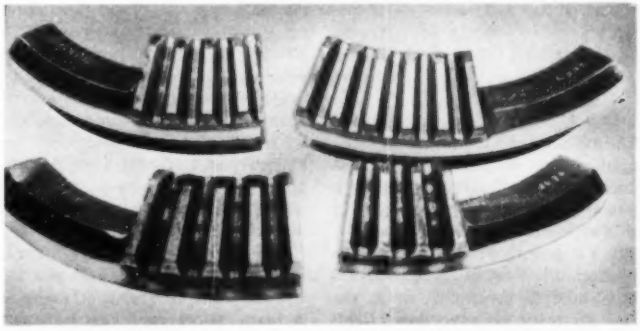


Fig. 4—Quenching while stria are formed in the root radius leaves hardened bands in the root radius of teeth at each corner and two or three between. This gear was heated with about 16-kw oscillator-plate input per sq in. of projected surface area

the current concentrating in well-defined bands or stria. These bands are well above the hardening temperature, while magnetic material between them is below. If the gear is quenched at such a time, definite hard and soft bands are produced, Fig. 4.

If the power is left off, stria in the center of the root radius will disappear and the center section of the root radius will cool off. This is accompanied by an increase in temperature of corners of the root radius where current density is the highest, Fig. 5. Now tooth tips are very hot, while roots, except the corners, are not above the critical hardening temperature. If the gear is quenched at this time, there will be no hardness in the root except at corners. The tooth is also likely to crack when quenched.

If power is left on still longer, heat conduction will increase the temperature of the entire root to above the Curie temperature. The stria effect will disappear except for some overheating of corners. By this time, tooth tips will probably begin to melt.

If a short heating time is used with a sufficiently high power density, stria will disappear and the entire surface of the tooth will be heated to above the critical hardening temperature before the core is heated above the hardening temperature and before the tip has become overheated. It is thereby possible to get a good contour hardness, with very high power density and correspondingly short heating time, if the gear is quenched just after stria disappear.

To see the effects of different heating times, at a high power density, take a typical example, Fig. 6.

Gears hardened like examples 6A and 6B have found use in some applications where the gear has been liberally designed. The high power necessary to heat a gear of this type limits the application. A 200-kw generator was required to harden this small gear. Unless equipment is available, or unless the quantity is very large, this method is uneconomical. A gear hardened at a heating time midway between examples 6A and 6B will give the best service.

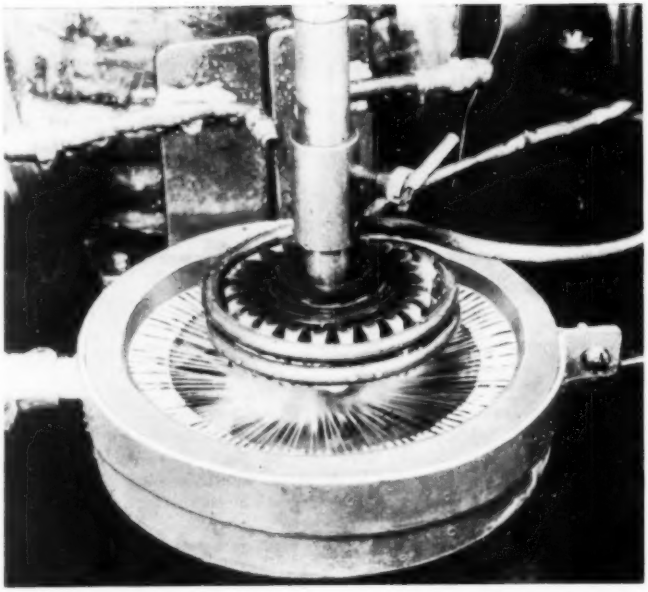


Fig. 5—Medium-density heating for a time causes stria to disappear from the root radius. Here corners of the root radius and tooth tips are being overheated, while the root radius is below hardening temperature. Teeth are likely to crack when quenched, the crack following the heat pattern closely

Contour-Hardening Gears by Preheating

WHILE it is possible to produce a contour-hardened gear by using a high power density at radio frequencies, this process has several limitations.

The large amount of power necessary makes this method uneconomical in most cases. By using only radio-frequency power, a 200-kw generator cannot handle a gear with more than 4.5 sq in. of projected tooth area. This corresponds to a gear of approximately 1.5 in. PD and a face width of 1 in. Present uses of this system have been limited to those installations where high-power equipment is available for other applications.

The short heating time and relatively low temperature reached by the steel in the root make it difficult to get good root hardness when using this process. Microstructure of the hardened steel in the root is not as good as that in the tips of the teeth where the steel reached a higher temperature. This limits application of this process to gears for light loads.

To overcome these limitations, the rim of the gear is preheated before application of rf power. By this method, it is possible to harden a gear, with rf, at a power of approximately 18-kw oscillator plate input per sq in. of projected tooth area. This means that the 200-kw generator can harden a gear with approximately 20 sq in. of projected tooth area. This makes the 200-kw generator economical for hardening transmission gears for small tractors and the like.

In this process, the gear rim is preheated by induction with a frequency in the order of 10,000 cycles per sec. A motor-generator set supplies power. After preheating, the gear is moved from the 10,000-cycle coil to the rf coil.

When preheat is used, the

Effect of Varying Power Level and Heating Time

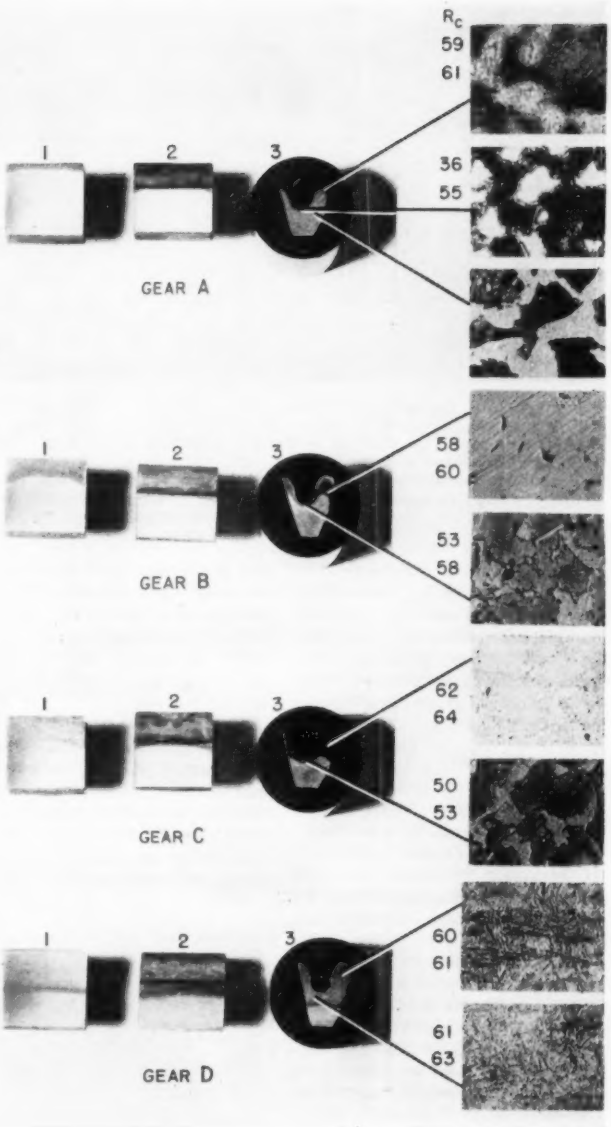
Fig. 6—Four 8-DP, 13-tooth gears of normalized 1045 steel heated with a frequency of 340 kc per sec with a 200-kw rf generator at various power levels and heating times. No preheat was used. PD is 1.62 in., face width 1 in.

Gear A was heated in 0.52 sec with oscillator-plate input of 41 kw per sq in. of projected tooth area at PD, and quenched 0.225 sec after power was removed. Section A3, midway between faces, shows some contour hardening around the entire tooth face. Tip hardness is 59-61 R_c, but root hardness only 36-55 R_c. A2, a section through the root radius, shows two places, ¼ in. from the sides, where hardness is very thin—the stria effect, not very pronounced because power density is high. Higher temperatures at root-radius corners shows up as deeper case there. The hardened case along the tooth tip, A1, is very uniform. Original pearlitic and ferritic areas are detectable at the tip, while pearlitic areas have been transformed at the root. Thus solution is incomplete.

Gear B was heated in the same way, but with 0.75 sec heating time. More of the tooth has been hardened, but there is still a contour pattern. Stria effect in the root radius has been eliminated, root hardness is a little deeper and is up to 53-58 R_c. Tip hardness is 58-60 R_c. There is not as much of a "contour," and the two thin spots are eliminated. The tooth tip has the martensitic structure of rapidly hardened steel. Root case still contains ferritic areas.

Gear C was heated for 0.97 sec. Root hardness is deeper and contour hardness is almost gone. Root radius hardness is 50-53 R_c (less than that of B); tooth tip hardness is up to 62-64 R_c because martensite formation is more complete. Root microstructure is like that of B.

Gear D, of 8-pitch, was heated for 14.5 sec at a frequency of 340 kc per sec and 2.85 kw input per sq in. of projected tooth area. It is through-hardened, with high hardness well below the roots of the teeth. Microstructure is martensitic in both root and tip, and tip martensite is almost like that of furnace-hardened steel



thermal power necessary to bring the surface of the gear tooth above the hardening temperature is reduced. This is because the gear enters the rf coil at approximately 1000 F instead of room temperature.

When a coarse-tooth gear has been preheated, the steel near the roots of the teeth is hotter than that near the tips, Fig. 8. This condition is enhanced by a delay of several seconds between preheat and rf cycles, permitting the tooth tips to cool faster than roots. Thus, when rf power is applied, the temperature gradient is such that conduction losses at tip and root radius are substantially the same. Hence temperature reached at tip and root radius will be approximately the same, so it is possible to produce a suitably contour-hardened gear.

The extent to which this reverse gradient is carried by preheating will determine the case at tooth roots. If that area is near or above the critical hardening temperature when rf power is applied, a very

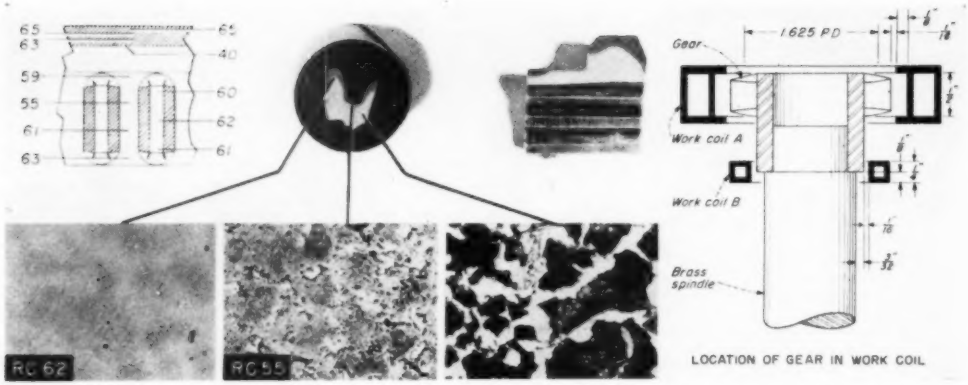


Fig. 7—An 8-DP, 1046 gear with 1.625-in. PD and 0.5-in. face is being contour-hardened by heating in 0.53 sec at 200-kc frequency. Two clashing surfaces and part of the hub are hardened at once. The work coil is shown. Note that the softest region is in the root radius near the tooth center—where the surface was raised to the lowest temperature. Root radius away from the long part of the hub is 63 R_c because of the high temperature reached there; nearer the hub the current spread out so hardness is lower. Tooth tips show traces of original pearlitic areas, while the root case has some ferritic areas in the original pearlite. Coil design and power control the amount of the hub hardened in the process

hard deep case is obtained. This, Fig. 9, is just the opposite of the effect obtained without preheat. Sample gears have been produced in which the roots only have been hardened. On these, there was very little hardness from pitch line to tooth tips.

Frequency Effect

Frequency used for final hardening has an effect on the results obtained. It is difficult to obtain good contour hardness with the rf generator frequency too high. The frequency effect is different for different tooth sizes (compare Figs. 8 and 10).

On gears with relatively small teeth, such as 8 or 12 DP, it is difficult to raise root-radius temperature above that of the tip when preheating with 10,000- or 3,000-cycle power. Best procedure is to preheat to a relatively high temperature. Most of the tooth will be above the upper critical temperature when the preheat power is removed. After this preheat, a delay of approximately 20 sec allows temperatures to equalize at approximately 1000 F, at which rf power is applied.

Because of economic limitations in design of high-frequency generators, the present process uses approximately 160 kc per sec for final hardening. This, in combination with high root temperatures obtained by increasing the preheating at a relatively low frequency, gives good results. The rf power is used for 0.5 to 1.5 sec, depending upon tooth size and power density.

The gear is usually removed from the rf coil for quenching by water spray. A delay between the end of the rf power cycle and the start of the quench cycle is beneficial. The heated contour pattern will not be materially changed by delay, and metallurgy of the hardened pattern is improved. The delay period depends upon the steel used, the heating cycle, and the results desired; a delay of up to $\frac{1}{2}$ sec may be used for an 8-pitch gear of 1046 steel.

Gear Is Rotated

During preheat, the rf hardening cycle, and the quench cycle the gear is rotated slowly. It should rotate three or four times during the heating cycle and at a speed sufficiently low, during quenching, so that the quench water will pene-

Fig. 8—When a gear is heated with a relatively low frequency (10,000 cps), steel in the roots tends to become hotter than that in tips as a result of skin effect and thermal conditions. This effect is exaggerated in this cutter because teeth are deeper and more pointed than those of a gear. Steel in the roots melted before steel in the tips

trate to the root radius. If the gear is rotating too rapidly, the water can not reach the root and root hardness will be low.

It has been found that a 4-lb 5-pitch gear requires a spray quench of 20 gal. of water per min for 17 sec to quench it to water temperature. Quench-water temperature of about 100 F prevents quench cracks on the sharp corners of the root radius of some gears. This practice is generally employed in water-quenching 1050 steel parts with thin sections and sharp corners. It also is beneficial to interrupt the quench when the heat remaining in the web is sufficient to bring the teeth to 300 F maximum and cool to room temperature in air.

Stress Relieving

It is not known whether the interrupted quench provides a sufficient stress relief. The system requires a careful control of quench-water temperature and pressure. Gears made at present are stress-relieved at 275 to 300 F in an oven following the above quenching procedure. Induction reheating to 325 F in a 10,000-cycle coil may eliminate the oven and minimize problems in controlling the quench cycle.

Clashing Surfaces

A number of gears have clashing surfaces, rounded surfaces where the gears first come in contact when they are engaged in a transmission. These surfaces must be hardened. These gears are hardened with an rf coil on which a projection is provided to harden the clashing surface at the same time the rest of the gear is hardened, Fig. 12. Some gears have clashing surfaces on each side. These can be hardened by using a coil with a projection on each side, Figs. 13 & 14.

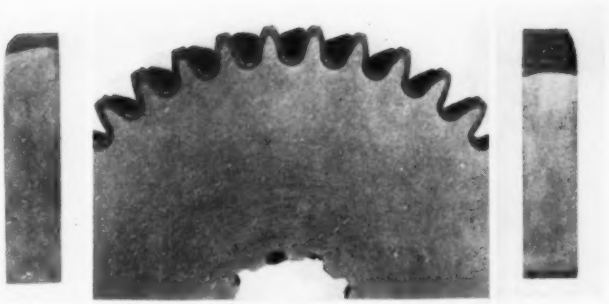


Fig. 9—Contour hardening with preheating produced a deep hard case in the root radius while tooth tips have soft corners because cooling of the tooth tips was carried too far

Cluster Gears

Cluster gears are best hardened one pinion at a time, because the rf power available is usually the limiting factor. If gears on a cluster are of two different diameters, it is best to harden the smaller one first, to avoid drawing the large gear while heating the smaller, Fig. 15. Simultaneous hardening is difficult because of current distribution.

If gears of a cluster are too close together, they will be difficult to harden. Preheating is difficult because heating one gear usually heats the other and destroys the previous heat-treatment. Application of the rf power is even more difficult. If there is any steel closer to the coil than the distance from the tip of the tooth to the root, it will be almost impossible to obtain a good contour hardness. To avoid these troubles, an undercut must be provided between the gears to a depth of approximately ¼ in. below the root radius, and the gears separated by approximately twice the distance from tooth tip to root radius.

Power Requirements

It has been found by experiment that, on 5- to 8-pitch gears, rf oscillator-plate input of approximately 17 kw per sq in. of projected surface area, at pitch diameter, is sufficient to contour-harden a gear, using the preheat method, if the face of the gear is less than ½ in. wide. For gears with ½ to 1¼ in. face width, 20-kw oscillator input per sq in. of projected surface area should be used.

To preheat gears at 10,000 cycles, from 2 to 3 kw per sq in. of projected tooth area should be used. This will give preheating times of 15 to 20 sec, depending upon the gear type.

To contour-harden small gears without preheat with results similar to that shown in Fig. 7, rf oscil-

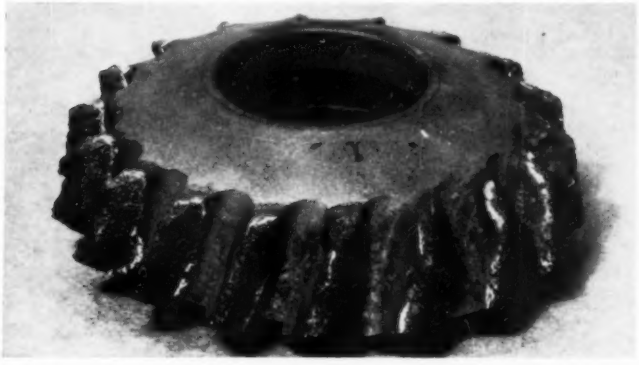


Fig. 10—A cutter like that in Fig. 8 heated at 275 kc per sec. Tooth tips have been melted, but roots are not. An intermediate frequency heated the desired portion of the tooth satisfactorily

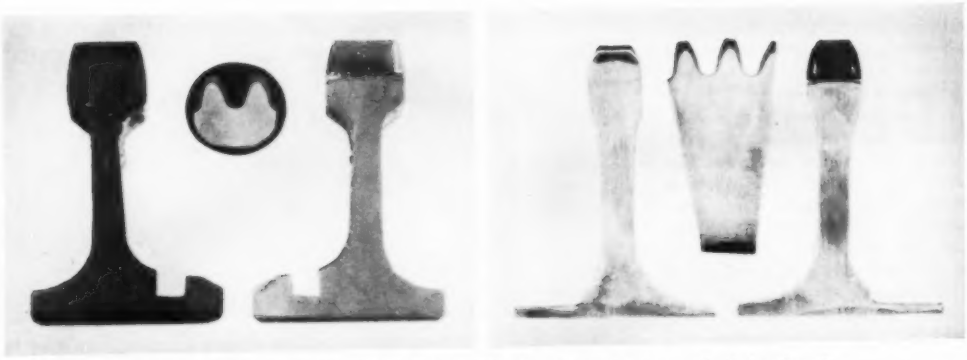


Fig. 11—These two gears, of similar material and contour, were both hardened with minimum preheating. The gear at left was contour-hardened at 400 kc per sec, that at right at 155. Note increased root hardness in the gear heated at 155 kc

lator plate input of approximately 78 kw per sq in. of projected tooth area should be used.

Metallurgical Considerations

As in conventional heat-treating, metallurgical results obtained in induction-hardened gears will depend upon steel and heat-treating process. Induction-hardening differs from conventional processes in that heating times are usually short and temperatures reached by the steel vary considerably over the surface of the piece. These conditions impose additional limitations on steel and upon results.

For through-hardening gear teeth, most low-alloy or plain carbon steels are suitable. If these are correctly handled, the same results can be expected with induction heating as with the conventional heat-treating processes—with the advantages, and disadvantages, of localized heating, of course.

Because surface temperatures are usually high and there is much cold steel behind the heated region, the stresses set up by quenching are probably more severe when induction hardening is employed. For this reason, a steel with a high hardenability should not be used unless special precautions are taken in quenching. Sharp corners should also be avoided.

A normalized plain carbon steel with carbon between 0.40% and 0.55% and with manganese between 0.60% and 1.0% is generally used for through-hardening gears by induction. Full hardness for the type of steel used is obtained. The heating times usually run from 3 to 20 sec, which provides sufficient time for complete austenitization.

The steel should be pretreated to insure an evenly distributed

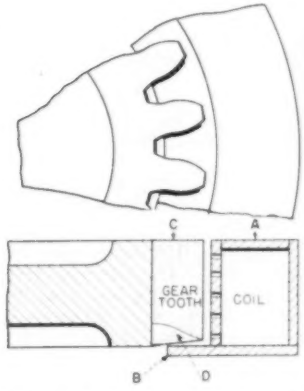


Fig. 12—Coils with a projection (B) harden clashing surfaces (D) at the same time the gear is hardened. The length of B determines how much of the clashing surface will be hardened. On 5- or 6-pitch gears with one clashing surface, B is 3/16 to ¼ in.; on 8-pitch gears, B is cut to 3/32 in.

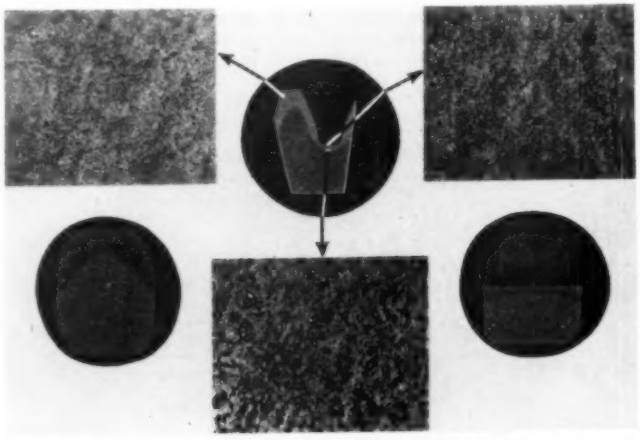


Fig. 13—If gears with clashing surfaces on both sides can pass through a coil with projections on each side, this hardness pattern results. Here projections were only ⅛ in. from the inside face to the coil. A deep-hard root was obtained by controlling the preheat cycle. Gears treated this way withstood a 150% overload run for more than 11,000,000 cycles without tooth failure

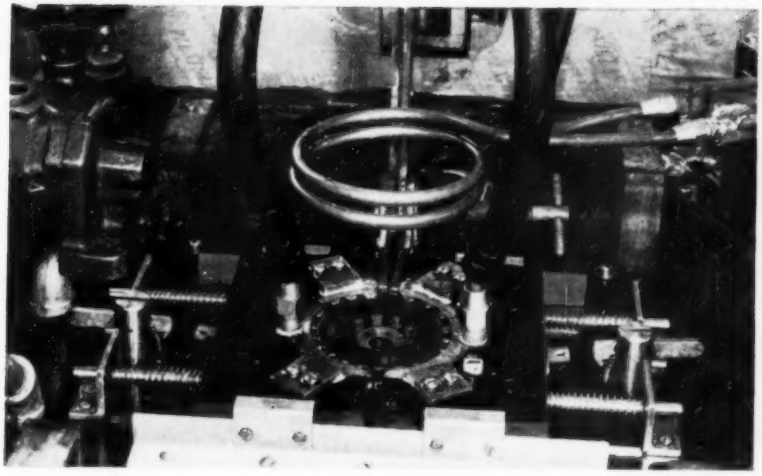


Fig. 14—If the gear cannot pass through, the coil must open. Here a tractor gear with double slashing surfaces is in the split rf coil, with the 10,000-cycle preheat coil above it

fine pearlitic structure. Annealed, spheroidized, or abnormal steels should be avoided, as there will be a tendency for these steels to retain free ferrite in the case because of the relatively short heating time. This will show up in poor wearing qualities and low surface hardness.

The steel used for contour-hardened gears must austenitize rapidly at relatively low temperatures because of the short heating time employed. The effect of increasing heating time for a given steel is shown by the photomicrographs in Fig. 6. These four examples give a good idea of what can be expected in heating 1045 steel for various times without preheating. They also show that if a good contour pattern is to be obtained at this power level, the microstructure will not be very good. This type of hardening can be used at times, however, as shown in Fig. 7.

When preheating is used, it is possible to get higher surface temperatures, with resulting improvement in metallurgy, Fig. 20. As well as making it possible to attain higher surface temperatures, the steel is placed in partial solution by the preheat power. This makes it easier for the final radio-frequency power application to form complete solution in the surface layer to be hardened.

Core Refinement

By controlling temperature to which the gear is preheated, time at elevated temperature, and cooling rate between the end of the

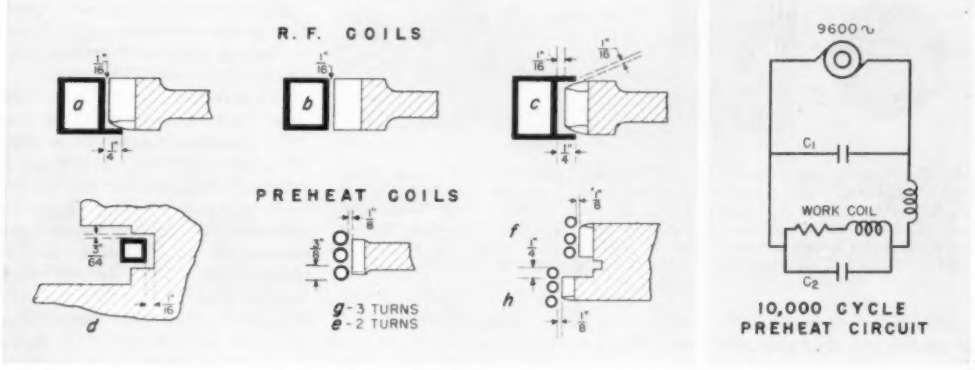


Fig. 15—These coils hardened the gears in Fig. 16. *d* is the split coil for hardening edges and corners of grooves for shifting forks (where they occur) with rf power only and 1- and 2-sec cycles. *a b* and *c* are rf coils; *e* to *h* are preheat coils. They were used thus:

GEAR (Fig. 16)	A	B	C	D	E	F
Preheat Coil	*e*	*h*	*e*	*f*	*g*	*b*
RF Coil	*a*	*a*	*c*	*a*	*b*	*a*

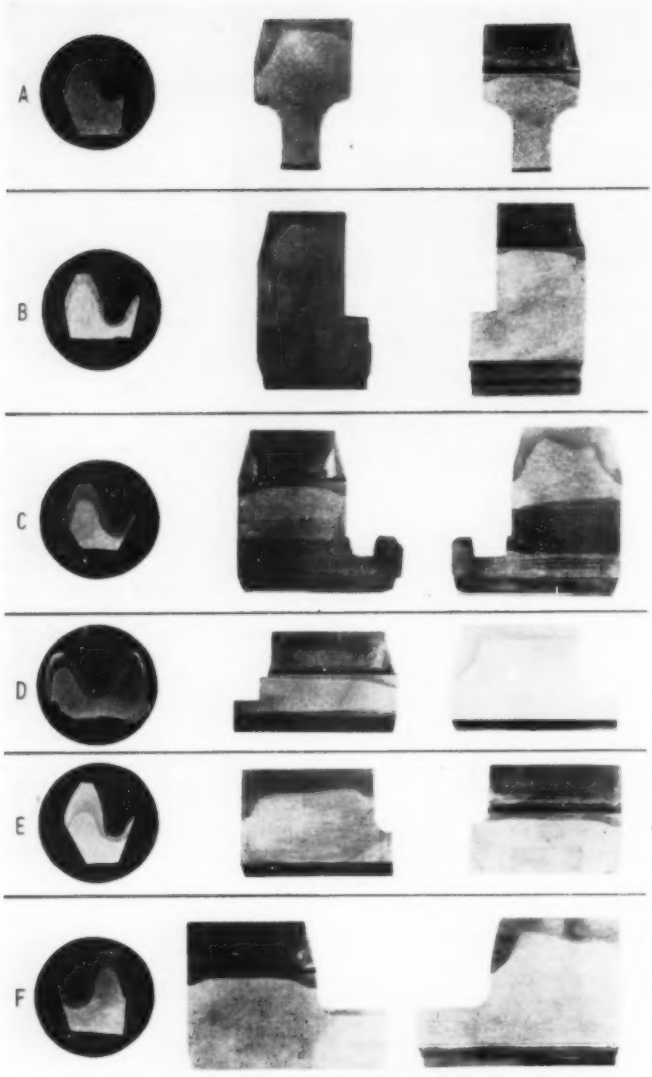


Fig. 16—Macrographs of sections of 6-DP gears preheated with 10,000 cycles and rf hardened show possible variations in hardness pattern. In each case the hardness pattern is complete across the root and tooth tips. There is no indication of stria at the root. C was hardenend in a split coil; note that the hardness pattern extends over clashing surfaces and gear face with more contour than that obtained with the short projections of Fig. 13

application of preheat and the start of application of rf power, a form of core refinement may be obtained. This gives the tooth increased strength. An example is shown in Fig. 19.

As far as known, the most suitable steel for induction contour hardening is a normalized steel with a fine pearlitic structure similar to that shown in Fig. 19. Carbon content should be 0.50 to 0.55%, manganese 0.60 to 1.00%, and low amounts of other residual elements. With this steel, it is possible to get surface hardness of at least 60 Rc on tooth tips and down down below the pitch line. A higher carbon content does not seem necessary, and raising the hardenability increases the tendency to crack.

Work-Handling Equipment

Equipment necessary to heat-treat gears by the preheating process consists of: a radio-frequency generator of suitable rating, 10,000-cycle generators for preheating and drawing, and work-handling and control equipment.

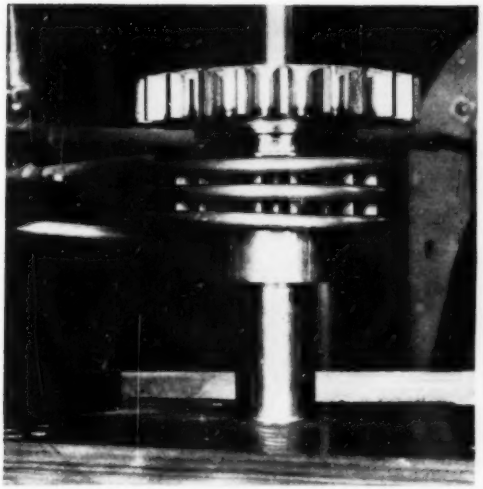
Generator

The size of rf generator required will depend upon the number of square inches of surface that must be heated on each gear and on tooth shape, and is more or less independent of the production rate because of ultra-short heating times.

Rating of the 10,000-cycle generator is determined by production rate. A preheating time of from 15 to 20 sec should be used. On this basis, 2 to 3 kw per sq in. of projected tooth area are required to preheat a gear. Power necessary for a given production rate can be estimated by calculating the power on a thermal basis assuming the rim of the gear is to be heated approximately to 1200 F.

Gang Preheat

More than one gear at a time must be preheated to meet a production rate of more than one gear every 30 to 50 sec. The exact number of gears preheated at one time depends on arrangement of the work-handling equipment. A simple production unit consists of a turntable with one or more preheating stations and a single rf station, or a conveyor can be used instead of the turntable. If the rf-generator plate current and heating time, and the 10,000-cycle generator output and preheating time are maintained at the same values throughout a batch of gears, it will be very unlikely that there will be any noticeable variation in heat pattern.



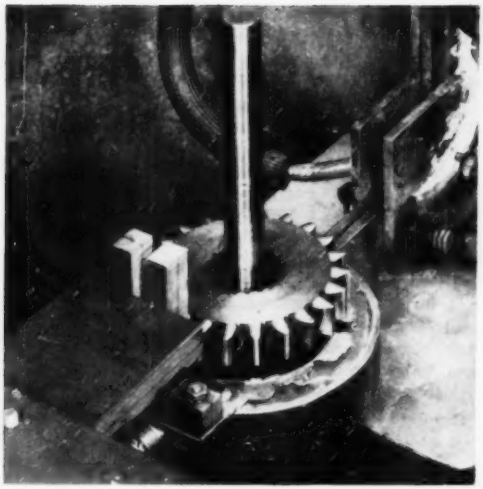


Fig. 17—Laboratory setups illustrate principles in preheating and hardening cluster gears. The smaller gear is treated first. It is preheated in a 10,000-cycle coil (left) for 15 sec, then moved (manually in this case) to the rf coil (right) for heat-treating. The larger gear is heat treated subsequently in the same way, then the notch between is treated in a single-turn coil without preheat. The gear is rotated in the coil for all operations

Quality of Gears

INDUCTION heating as applied to heat-treating gears is a recently developed process. At the present time, some field tests have been made and a number of gears have been proved and are now in production.

Tests indicate that induction contour-hardened gears are as good as carburized gears in some respects. The induction contour-hardened gear has a relatively deep case that tapers off in hardness from the surface of the tooth. This type of hardness stands up well against shock and stress loading. Core refinement that may be obtained results in further improvement in tooth strength.

Relative Cost

ASSUME that the plant wants to harden and draw 500 4-lb gears an hour. This would be a gear of approximately 7 in. OD with a 9/16-in. face. The operating cost, based on 3760 production hours per year, including amortization, power cost at $0.01 per kwhr, tube re-

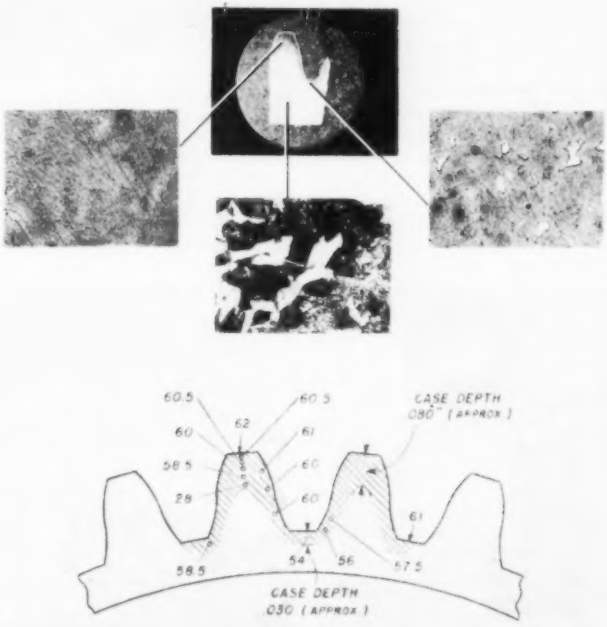


Fig. 18—This induction-hardened 8-DP gear, like that in Fig. 13, is for a tractor transmission. It was preheated with 10,000-cycle power, hardened with 200,000-cycle power. The sketch shows Rockwell C hardnesses at the indicated points. In dynamometer tests, this gear withstood a 150% overload run for more than 11 million cycles without a tooth failure. While the gear is liberally designed, the heat treatment is also exceptional

placements, labor at $3 per hour, and maintenance, will be approximately $13.45 per hour, or a cost of $0.027 per gear.

The cost to carburize gears of this size in large quantity will be $0.015 to $0.040 per lb, depending on the method used. This means the 4-lb. gear will cost somewhere between $0.06 and $0.16 to carburize, or 3 to 13 cents a gear more.

There is also a saving in the cost of steel used. Take a gear made from 4028 steel and replace it with a gear made from normalized, carbon-restricted 1050 steel. Relative costs are approximately $3.75 per 100 lb for the 1050 steel and $4.05 per 100 lb for the 4028 steel. The savings in steel cost will probably amount to two or three cents a gear.

Induction contour - hardening will often eliminate a copper-plating operation on a spline bore or some such surface. This will save a cent or two per gear.

An economic analysis will have to be made for each set of conditions, but the foregoing cost figures show that savings of ten cents a gear are not unlikely. There are further savings from reduced handling. In carburizing, gears are handled several times, which is a large part of the carburizing cost.

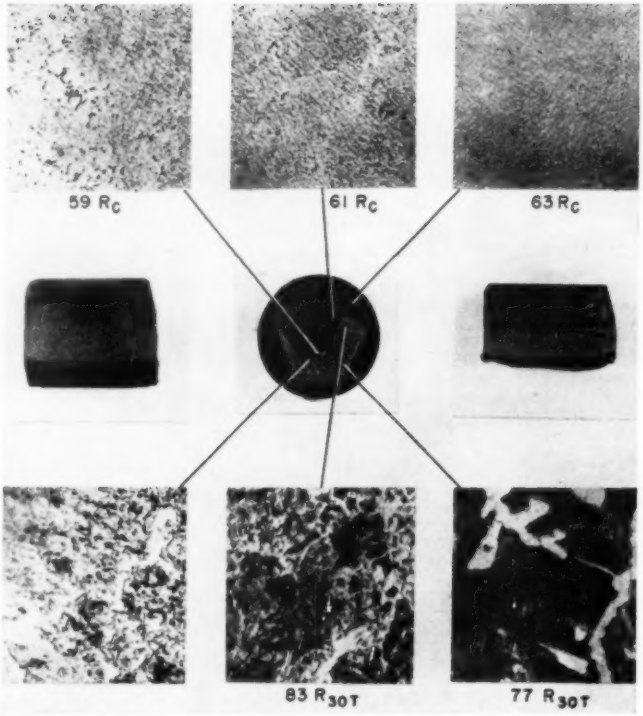


Fig. 19—A 5-DP, 21-tooth, 1050 gear preheated for 20 sec with 43 kw of 10,000-cycle power to raise a large portion of the tooth above upper critical temperature. Delay of about 20 sec allowed teeth to cool to 1000 F, then rf power was applied. Note good case metallurgy and core refinement. Original structure was 77 R_{30T}; after treatment the tooth core at pitch line was 83 R_{30T}. The pattern of preheat core refinement (micrograph of section through tooth) is independent of the hardened case put on by rf power

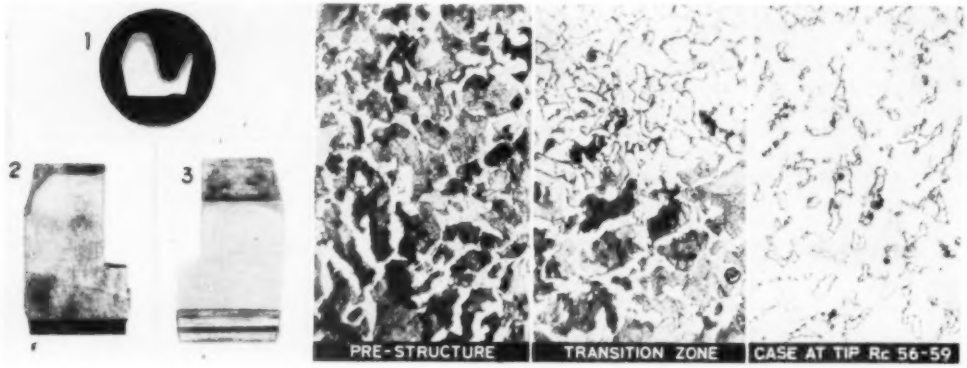


Fig. 20—Effects of too-low temperatures and too-short heating times. This 6-DP, 1045 gear was preheated to about 900 F, then hardened with rf power at 26 kw—more than necessary. The hardened case still contains considerable free ferrite; surface hardness is 57-58 R_c. Had preheat been higher, rf heating time longer, and carbon content 0.50-0.55, case structure would be better. Contour hardness pattern is not deep enough because rf heating was about 0.1 sec short. Field tests of 1600 hr showed signs of pitch-line spalling but no breakage

Simple Equation Gives Machinability Values

Relative machinability of SAE steels with 18-4-1 high-speed tools can be determined quickly by using formula based on many shop tests

BY JAMES SORENSON
and MARLOWE PETERS,
THE FOUR WHEEL DRIVE AUTO CO.

MACHINABILITY has been studied carefully for a number of years by methods engineers and metallurgists at the Clintonville plant of the Four Wheel Drive Auto Co. Latest results obtained from their studies is a simple equation for calculating the relative machinability of SAE steels when using 18-4-1 high-speed lathe turning tools at a standard tool life of one hour.

In determining the relative machinability of a group of metals in a given production shop, there are many factors to be considered. Different machining and heat-treating procedures will result in considerable variation in the relative machinability of steels and other metals. And for the same metals, type and condition of machine tools result in different machinability ratings in many cases. For example, ratings obtained from turning tests in a lathe with a single-point tool usually will be very different from those obtained when tests are made on a milling machine or a drillpress. Likewise, relative machinability ratings obtained by tests and experience in one production shop often will differ from those determined in another plant.

Nevertheless, many manufacturers have found such ratings especially valuable, and base numerous design and production decisions upon relative machinability studies carried out in their own shops. While the results obtained from the following equation for machinability cannot be considered as absolute values, experience at Four Wheel Drive indicates that the equation has considerable use in comparing the relative machinability of the various SAE steels.

All tests on which the equation is based were made in a modern 14-in. standard engine lathe, using the same form of tool for each cut. Inasmuch as SAE 1112 Bessemer free-cutting steel has been used by other investigators as a basis for evaluating the relative machinability of steels, this steel was taken to represent 100% on the machinability rating scale in the development of the equation. Hence, any machinability rating or M values determined by the equation should be considered as relative to SAE 1112 Bessemer free-cutting steel as the base, or 100%, rating.

Specific ratings are obtained from the following expression:

$$M = A + K_1C - K_2E - \frac{T}{K_3}$$

Where:

- M = Relative machinability rating in percent.
- A = Constant, see table.
- K_1 = Constant, see table.
- K_2 = Constant, see table.
- K_3 = Constant, see table.
- T = Tensile strength of the steel, in 1000 psi.
- C = Percentage of carbon, up to 0.25%, as points.
- E = Elongation, in percent.

In determining this equation, we found that such factors as microstructure, strength, grain size, ductility, and chemical composition, as it may affect microstructure, must be considered. Hence, in the table, we have grouped each type of steel as to chemical composition and have supplied different constants in each group to cover each individual condition, as our experiments and shop experience have shown that these factors influence relative machinability.

Steel, for best machining, should be soft and brittle. However, this is not possible—steel is either soft and tough, or hard and brittle. In regard to microstructure as obtained in normalized or annealed steels, excessive coarsening, or increasing the size of pearlite, reduces machinability probably because of the greater power required to remove or deform the large or coarse pearlite colonies. Hence, the ideal microstructure for maximum machinability at high surface speeds in low, straight-carbon or low-carbon, low-alloy steels is pearlite of medium size, uniformly distributed, with an envelope of ferrite surrounding each pearlite crystal. This condition permits the tool to cut through the soft ferrite matrix without encountering any large individual pearlite crystals or colonies.

Where low surface speeds, heavy feeds, and heavy depths of cut are involved, a spheroidal microstructure will be most satisfactory. However, coarse spheroids will usually machine more readily than fine spheroids. This is because of their lower strength, and possibly because the coarser spheroids may help to prevent build-up on the nose of the cutting tool. But in

CONSTANTS FOR CALCULATING RELATIVE MACHINABILITY

SAE Steels*	Condition of steel	Constants A	K_1	K_2	K_3	Micro-Structure of Annealed SAE Steels
Series 1000: Carbon Steels	As Rolled	108	2.00	1.00	1.00	SAE 1020, 1030, 1040: medium-size pearlite & ferrite
	Annealed	173	1.00	2.00	1.00	SAE 1050 and 1060: ferrite & spheroidized pearlite
	Quenched & tempered to 300 Brinell max.	185	0.50	2.00	1.00	SAE 1070, 1080, 1095: spheroidal, carbide plus ferrite
	Cold Drawn	94	1.20	1.00	2.00	
Series 2300: Nickel Steels	Annealed	177	0.20	1.50	1.00	SAE 2320, 2330: medium-size pearlite & ferrite
	Quenched & tempered to 300 Brinell max.	175	0.50	1.00	1.00	SAE 2340, 2350: ferrite & spheroidized pearlite
	Cold Drawn	155	1.00	1.00	1.00	
	Annealed and Cold Drawn	96	1.00	1.00	2.00	
Series 3100: Low-Chrome Nickel Steels	Annealed	124	2.00	1.00	1.00	SAE 3115, 3120, 3130 3140, 3150: medium-size pearlite & ferrite
	Quenched & tempered to 300 Brinell max.	113	0.50	1.00	2.00	
Series 3200: Medium-Chrome Nickel Steels	Annealed	130	1.60	1.00	1.00	SAE 3220: medium-size pearlite & ferrite
	Quenched & tempered to 300 Brinell max.	202	0.20	2.00	1.00	SAE 3230, 3240, 3250: ferrite & spheroidized pearlite.
Series 3300: High-Chrome Nickel Steels	Annealed	147	1.20	1.00	1.00	SAE 3312: medium-size pearlite & ferrite SAE 3340: ferrite & spheroidized pearlite
Series 4100: Chrome Molybdenum Steels	Annealed	147	1.00	1.00	1.00	SAE 4120, 4130: medium-size pearlite & ferrite SAE 4140, 4150: ferrite & spheroidized pearlite
Series 4300: Chrome Nickel Molybdenum Steels	Annealed	105	1.00	1.00	2.00	SAE 4340: ferrite spheroidized pearlite
	Quenched & tempered to 300 Brinell max.	160	0.50	3.00	2.00	
Series 4600: Nickel Molybdenum Steels	Annealed	151	1.00	1.00	1.00	SAE 4620, 4630, 4640: medium-size pearlite & ferrite.
	Quenched & tempered to 300 Brinell max.	118	0.50	1.00	2.00	
Series 6100: Chrome Vanadium Steels	Annealed	98	1.00	1.00	2.00	SAE 6120: medium-size pearlite & ferrite
	Quenched & tempered to 300 Brinell max.	203	0.50	2.00	1.00	SAE 6140, 6150: ferrite & spheroidized pearlite
	Annealed and Cold Drawn	175	1.00	1.00	2.00	

*Grain size: 5 to 8, according to Classification E-19 of the American Society for Testing Materials.

eutectoid and hypereutectoid steels, if the spheroids become excessively coarse, or if a noticeable amount of pearlite is present, excessive tool wear may be encountered.

While machinability has a definite relation to structure, it is also apparent that physical properties exert their influence. For example, the ductility of steel indicates to some extent how chips will cling to the tool, and tensile strength will give some indication of the power required to thrust the cutting edge of the tool under the chip. Also, as elongation is an expression of ductility of the material, low elongation means less interference from chips balling up on the tool.

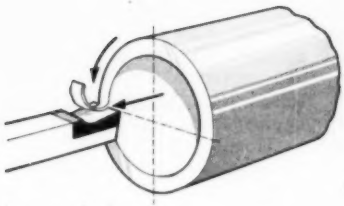
As a usable mathematical expression, the equation is a tool that can be of considerable value in guiding decisions on machinability problems arising under conditions similar to those listed in the accompanying tabulation.

Executive Development

"Put yourself in the place of your supervisors," advised F. E. Verdin during a recent address before the American Management Association.

"If I were to prepare a "DO" list for you, I would say do the following: First, convince yourself and your top management that foremen, supervisors, and other administrative people *are* management. Second, put yourself in their places and think what they might want. Third, analyze their wants, determine their practical and psychological values. Fourth, take progressive steps to provide as many of these values as is practical for you to provide in your organization. And fifth, treat them as management according to their degrees of responsibility.

If you will do this conscientiously and sincerely, you will find among other things, improved communications up and down the line, greater harmony and cooperation, a smoother functioning management group, stimulated production, better understanding of management problems and principles, and above all, more and better equipped candidates for advanced Executive Development."



A convenient orthogonal cutting arrangement

Choose Your Steel For Better Machinability

Every cutting operation is affected by the composition of the steel selected.

Knowledge of basic reasons for "free-machining" can help cost reduction

TOOL and power costs go down; production goes up, when the basic reasons for good machinability are observed. Factors which provide the qualities for free-machining can help eliminate the guesswork when selecting steels.

The machinability of steel is improved by the (1) addition of sulfur (2) addition of lead (3) addition of sodium sulfite and (4) cold working. Steels so modified could be called "free-machining" in the very broadest sense of the term. (It is recognized that cold-worked steels are not usually considered to be free machining.) Heretofore, knowledge of the reasons for the improved machinability resulting from these modifications has been limited, hence this investigation.

Five pairs of steel samples, each consisting of one normal and one free-machining material, were selected for test:

1. Type 303 (sulfur) stainless and Type 304 stainless
2. AISI C-1022 leaded and AISI C-1019 (plain)
3. AISI B-1113 (sulfur) and AISI C-1019 (plain)
4. AISI A-8640 (sodium sulfite added) and AISI A-8640 (plain)
5. SAE 52100 cold-drawn tubing and SAE 52100 cold-drawn and annealed tubing.

Machinability, relative to free-machining steels, may cover a multitude of performance characteristics. For the purposes of this investigation, three characteristics of which one or more are noticeably improved by free-machining modifications, are examined.

1. Tool life obtainable under given machining conditions.
2. Surface finish.
3. Tool forces and power consumption.

Test materials and their relative machinability may be judged from the tabulated data. The tool life values are limited to individual pairs for comparison. Some cases are expressed in terms of constant tool life while other cases as the elapsed cutting time between tool grinds. The values given for surface finish, tool forces, and power consumption are comparable between pairs as well as within them.

Understanding of the basic properties which influence or control machinability is limited. However, certain properties, which have considerable influence on machinability, are known. Most of these, excepting abrasiveness, can be expressed quantitatively. Division of these properties into two classes results in: (1) properties that control the geometry and mechanics of chip formation and (2) other mechanical properties. These basic properties which are the main variables of (1) are:

1. Coefficient of friction between chip and cutting tool
2. Resistance of the material to

Machinability Characteristics of Steels Used in Tests

Material	Relative Tool Life or Equivalent Cutting Speed, fpm	Relative Surface Finish, Microinches rms	Relative Cutting Force, lb	Relative Thrust Force, lb	Relative Power Consumption HP min cu in.
STAINLESS					
Type 303 (Sulfur)	100-130	20-30	167	98	0.94
Type 304	70-90	6-9	222	177	1.25
C-1022					
Leaded	160-190	30-40	101	24	0.57
B-1113					
Sulfur	210-235	25-35	106	37	0.60
C-1019					
Plain	120-140	60-70	167	115	0.94
A-8640					
Sulfite-Treated	5 hr. per grind at 111	65-85	199	148	1.12
Plain	2½ hr. per grind at 88	65-85	206	157	1.16
SAE 52100					
Cold Drawn	90-95	6-7	197	129	1.11
Annealed	85-90	6-7	210	149	1.18

From a paper by M. Eugene Merchant and Norman Zlatin at the Thirtieth Annual Convention of the American Society for Metals.

plastic deformation during cutting.

3. The machining constant of the work material. "Other mechanical properties" includes; strain hardenability, bulk hardness, and abrasiveness in the makeup of the microstructure.

Cutting tests were run using an orthogonal cutting arrangement, wherein the tool has a single, straight cutting edge which is set at right angles to the direction of tool, relative to the work. Removing a chip continuously from the end of a tubular workpiece satisfies this arrangement (see diagram). Employment of a sintered carbide tool together with cutting speeds greater than 200 fpm provided a Type 2 chip. The rake angle on the tool was +10° and the relief angle, 3°. Tubing wall thickness (corresponding to depth of cut in a normal turning operation) was 0.25 in.

A range of feeds and speeds was used in the tests on each sample. The values plotted show that the coefficient of friction is influenced both by changes in speed and changes in feed.

This investigation provided a number of conclusions. The main reason for improved machinability of the high sulfur steels lies in their lower coefficient of friction between chip and tool. However, sulfur seems more effective toward friction reduction in plain carbon steels than with the stainless steels. Low coefficient of friction values found for the high sulfur steels may be attributed to the action of the sulfide inclusions during the cutting process. The heat of friction should cause these to melt and "smear" over the tool face—thus allowing the chip to slide freely over the tool face. The addition of sulfur in the stainless steel samples also resulted in an increase in the machining constant. Although the reason for this increase is not known, the effect is beneficial. However, it does not appear to be general—either for other types of stainless or for plain carbon steels. Sulfur in the steels tested had only slight effect on their shear strengths. Sulfurized steels produced just as continuous a chip as the plain steels. Thus the idea that improved machinability of sulfur steels is due to reduced shear or tendency for chip to become discontinuous is disproved.

Lead has an effect on machinability very similar to that of sulfur, and for the same reason. In fact, lead seems a little more efficient in reducing the coefficient of friction. Use of lead in preference to sulfur is advantageous in that lead has little or no adverse effect on the performance characteristics of the steel in service.

Sodium sulfite added to one of the pair of A-8640 steel samples produced improved machinability in one sense. Tool life was increased considerably, but all other properties were the same. Improved tool life is probably a result of the reduced abrasive structure of the steel brought about by the fluxing out of the silicate and aluminate inclusions by the sulfite. Note that this evidence of improved machinability would not be brought out by measurements of forces or power consumption alone.

Cold working (SAE 52100) produces a slight increase in the machining constant, a decrease in strain hardenability, and an increase in the hardness. These effects oppose each other to some extent with regard to their influence on tool life. However, except for abrasive action due to increased hardness, they are beneficial to surface finish, tool forces, and power consumption.

Hoist Serves Fireproof Oil Room

BY WALTER RUDOLPH

PROPER PLANNING has reduced manual handling and minimized fire hazards in the oil room at Lord Mfg. Co., Erie, Pa. Heavy drums are moved by monorail hoist through a fire door into a room apart from the receiving and storage area. Drums then are mounted horizontally on a concrete, dirt-filled bench built at convenient height for handling and dispensing.

For storage of a second barrel of the same kind of oil, a special rack is placed over the drum on the bench. Made of 1-in. pipe, this rack is fitted with $\frac{3}{8} \times 2$-in. straps curved to fit the diameter of the shallow ditch that drains spilled oil to sewage outlets at the corners of the room. These drainage facilities, plus the slab top and tile front on the bench, permit regular hosing of the room and removal of all oil that reaches the floor.

ROUND TABLE

Subordinate Dictator

"I see my old 14-in. lathe is in here for repairs," frowned Al. "How long have we had it in the plant?"

"Oh, I'd say about ten years, Al."

"How long d'you figure it'll be out of commission? I hope it won't be too long because that big order is coming through for Marshal," said Al. "Do you suppose you can engineer a quickie repair so as not to hold it up?"

"Al, I'm afraid we'll have to give the old girl a good overhaul; she's had a pretty tough run of it, going through those non-stop war days and all. Morrison says he'll have her shipshape in two weeks if he has any luck."

"Two weeks! Why, man alive, we can't spare her that long!"

"I'm afraid we'll have to abide by Morry's decision, Al. He should know what the machine needs."

"Morrison isn't the foreman of the shop, Ed; that's up to you to say what's to be done."

"I agree with you there, but I told him that he was to take charge of the upkeep of the machines. If he says that a machine needs a certain thing—and in this case I agree with him—I'm going to do as he advises."

"Don't you think you are making a mistake in letting one of your subordinates dictate what is to be done?"

"I'm not letting anyone dictate to me—outside of my immediate superior," replied Ed. "Look here, Al, you'll have to admit that the equipment in our shop is in darn good running order—take that universal grinder, for instance; why all the fellows have told me that they have been saved hours of time since Morrison tore the thing apart."

"I don't know, Ed, it seems to me that you are stressing a man's importance too much. Why should Morrison's word be taken? Is he the only guy around here who knows how to fix a tool? Why should he decide?"

"Because he knows his job, Al. If he says the machine should be fixed a certain way, that's the way he's going to fix it. He knows his business. When I have a good man, whose chief job is to keep the equipment in shape, I'm taking an unnecessary load off my own shoulders—you ought to see the machinery chart that boy has fixed up for the job. It's uncanny how he can anticipate repair needs. Believe me, that saves time when something does give out."

"Looks like the man is looking for trouble," frowned Al.

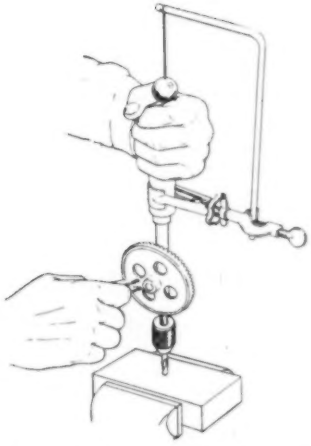
"No, not exactly, Al—just has his eyes open to give trouble the old one-two."

***Should responsibility** for one phase of an executive's job be shifted to a subordinate? How far can you go in letting an assistant tell you what to do? Your ideas on this subject can help others. Discussions of earlier topics appear on later pages.*

Mike Tenths by Touch—Standard 0-1.0-in. micrometer plus a simple vernier sliding bar and a collar provide a means of measuring sizes accurately within 0.0002 in. by touch. Raised lines on the vernier and the collar replace the usual numbers. The "mike" is set to the part to be measured and the size to the nearest 0.025 in. is determined by sliding the vernier bar up against the lower edge of the knurl, then locating, with the fingernail, the two raised lines of the vernier most nearly in line. Measurement to less than 0.001 in. is accomplished by feeling the position of the raised lines on the collar with relation to a fixed point on the bar

SIGHT AT YOUR FINGERTIPS

Simple, mechanical aids provide new horizons for the blind technician and make it possible for him to do even "close" jobs accurately



Laboratory-devised Drill Positioner—Drilling a straight hole by eye is difficult. Without sight it was almost impossible, until this simple device was used. A laboratory clamp, a bent rod, a piece of string, and a brass ball were assembled and clamped to the drill handle. The handle is held so that the forefinger and thumb encircle the ball loosely. Pressure of the ball on any part of the thumb or finger indicates the direction of lean. When the ball is free, the drill is straight

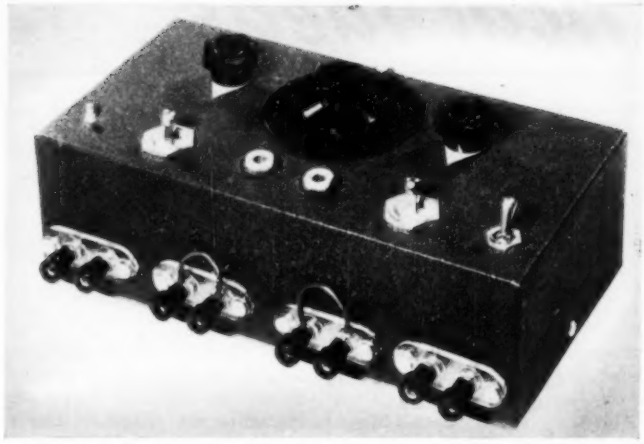
DEVELOPMENT, by various research organizations, of specially adapted instruments and tools provides many new opportunities for the gainful employment of the blind. Precision work, heretofore considered too difficult without sight, is now possible with a degree of accuracy comparable to that of people with sight.

The American Foundation for the Blind, a non-profit, national research agency, specializes in the problems of people without sight. As part of its program, it operates a department for technical research. Although small, with limited facilities, this section has produced a number of remarkable tools and has adapted many varied instruments and gages for use by blind engineers and technicians.

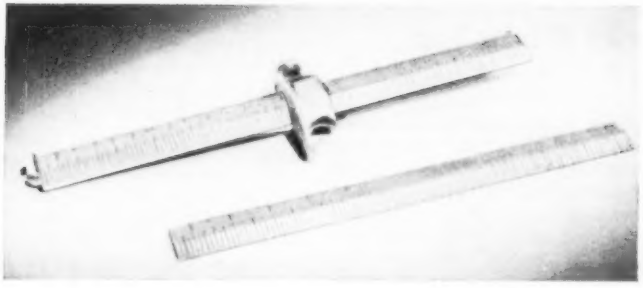
Dr. Clifford M. Witcher has been co-director of the technical department for three years. Blind since birth, the doctor holds a degree in electrical engineering and his doctorate in nuclear physics. Prior to joining the Foundation, he was a research physicist on radar at the Bell Laboratories. Many of the inventions are the result of his ingenuity and personal knowledge of the problems of blindness.

Practicing engineers, and students, are not comfortable without three basic tools: sketch pad, micrometer, and slide rule. All three, available from the research department, are practical devices.

The sketch pad consists of a common clipboard, on one side of which a sheet of soft rubber 1/16 in. thick has been cemented. A sheet of special moisture-proof cellophane, which serves as the "paper," is clipped against the rubber sheet. Drawing is done with a ballpoint pen which has a slightly enlarged ball. Pressing the pen against the cellophane as if using an ink pen —but with more weight—produces a raised line on the cellophane which can be easily traced with the fingertips. A Braille writer, notched at every inch, with $\frac{1}{4}$-in. character spacing, serves as scale, straightedge, and lettering guide. Using ink in the pen provides a line which can be readily seen by coworkers



Electrical Measurement by Ear. Volts, amperes, and ohms are readily measured with the Foundation radio analyzer. The unit, consisting of the analyzer, a headset, and two test leads connected appropriately, provides a constant signal when the device is turned on and set to the desired scale. The large dial is turned slowly until the signal stops, then the Braille numbers are read from the surface of the dial, multiplied by the scale factor, and the answer is the actual quantity



Measure and Mark Manually—Rule and marking gage for patternmakers are readily manipulated by "feel." Raised lines and Braille numbers simplify the use of these measuring tools for the blind

or can be printed photographically.

Modification of a slide rule for touch reading was a more difficult problem. The circular type rule was selected for its increased span and a 12-in. diameter was chosen for the logarithmically divided circle. Large raised numerals denote the whole numbers, while single and double raised dots subdivide the spaces between. Plastic pointers complete the rule. Operation is identical with that of a conventional circular slide rule. Reading is done by feeling the location of the pointers with regard to the raised numerals and points. Ingenuity reduced the cost as well; a standard record mold was adapted to produce the disk accurately and fast.

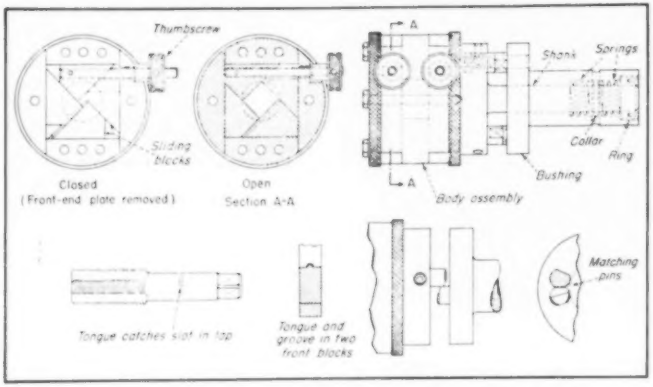
Tools are produced for many trades. Machinists and patternmakers can be provided with scales, vernier caliper, depth gage, center punch, drill positioner, marking gage, and nail pusher (to drive finishing nails without a hammer); just to mention a few.

Laboratory and photographic technicians, radio repairmen, and physicists have available thermometers, barometers, indicators, and a specially designed radio analyzer for all the common electrical measurements. The Foundation research section spends considerable time solving the problem of individual needs. It also has provided many devices to ease the burden of blindness for the housewife and businessman.

If you were to go blind you would want to do things for yourself. But you would need help. Any device which compensated for a lack of sight would be a far greater contribution than even the most generous monetary gift. The first would provide a sense of capability and security while the latter only emphasizes the handicap and deflates self-esteem. Charity must be provided for those who cannot help themselves, but every effort expended to provide the blind with a means of self-support pays dividends many times over. Direct charity is always a debit to the sightless recipient.

Employment of the blind in manufacturing plants is considerably retarded by the antiquated notion that they are helpless or unsafe. Actually, investigation has shown that blind employees generally are a good investment. They are capable workers, less subject to the distractions of the shop atmosphere, and their safety record is well above the average for employees with sight. In many plants the presence of blind workers is an incentive for those with sight to protect it, thereby improving the general safety level.

Practical Ideas



Universal Holder Locks Many Tap Sizes in Turret Lathe

POSITIVE ENGAGEMENT and release at full depth are advantages of this tap holder that will clamp a range of common tap sizes almost automatically. The device is made with a flanged bushing that fits into the turret and a body assembly that holds a tap.

Two sets of sliding blocks in the body assembly clamp down on the tap. The rear set, which is independent of the front set, tightens on the square section of the tap shank through a thumbscrew in the side of the body. A second thumbscrew controls the front set of blocks, which clamps on the round shank. Two of the front blocks are joined to each other with a tongue and groove. The part of the tongue that is exposed to the tap in the hole between the blocks catches in a slot that is cut in the tap. This slot is aligned with the square end section, and is located the correct distance from the butt end of the tap, so it will fit exactly. The arrangement prevents in and out movement of the tap, once it has been caught in the clamps. The rear set of blocks, which clamps on the square section of the tap, prevents angular rotation inside the holder.

The shank of the body assembly is fitted to the bushing by means of two compression springs, one on each side of a collar attached to the body shank. The front spring bears against the end of the counterbored hole in the shank, and the rear spring is confined by a ring or hollow collar that is screwed into the end of the bushing. This allows some flexibility in the junction and prevents damage from shock.

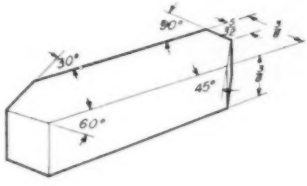
Engagement between the two parts of the unit is through a set of two pins in each part. These are made from round drill rod, with the matching faces cut off to give surface-to-surface contact. The faces are cut along radial lines out from the center of the device.

The pins in the body are spring-loaded to reduce shock and to act in the tapping cycle. The turret is fed toward the work with the pins engaged. Proper location of a turret stop allows the tap to feed the body out of the bushing until the pins disengage. This should happen at the bottom of the hole. With the pins disengaged, the body and tap rotate with the work and the tap does not feed in farther. Then the lathe spindle is reversed, the turret is moved closer to the work by kicking out the turret stop, and the pins engage—but in reverse. The turret is retracted as the work turns the tap back out of the hole until the tap is freed. The springs in the bushing allow some leeway in the action, which prevents tap breakage. *R. B. Wolverhampton, Staffordshire, England.*

Tool Aligns Lathe Bit For Turning Chamfers

PLENTY OF TIME is wasted by the avearge lathe hand in setting a tool to a given angle for a chamfer. Usually the machinist uses a protractor or the compound dial to set the exact angle, when actually the chamfer doesn't have to be very accurate and is only designed to break a sharp edge.

The simple tool illustrated will help in lining up the tool for the common angles—30°, 45°, 60°, and 90°. Simply hold the end of the tool with the desired angle against the flat end of the toolbit and swing

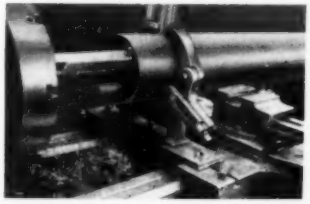


the tool or holder so the tool lines up with either the ways or the cross-slide of the lathe.

The angles are etched on the corresponding ends of the tool. *Robert N. Adams, Kendallville, Ind.*

Threading-Dial Timing Controls Double Screw

DOUBLE THREADS can be cut easier if the tool is not shifted in the cross-slide. After the first thread has been cut, the second can be started by engaging the nut on the feedscrew when the threading-dial indicator comes opposite a halfway point between numbers. This will run the tool along the work in just the position it must have—half way between roots of the first thread. *Thomas Watkins, Wilmington, Del.*



Chuck Swings Boring Toolbit In Heavy, Braced Holder

OUR LONGEST LATHE is only six feet between centers, and not long ago we had 90 eight-foot tubes that had to be bored inside each end to a depth of 13 in.

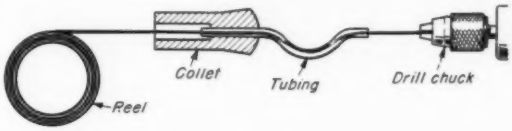
We mounted a steadyrest at the end of the bed, and another on the front end of the carriage. Once they were set, they required no adjustment except for slight variations in roundness and size of the work, which was handled by readjusting the front rest.

An unusually strong boring bar was made by welding small blocks to the back of the regular bar and welding a second bracing bar to the blocks. The ladder-like bar assembly swung from the chuck and was quite rigid and strong.

The carriage fed the tubing into the toolbit as it was rotated, and the cuts were found to be accurate. No chatter was developed. This method is one we would now use for any similar setup, even if we had a lathe with the capacity for a conventional setup. *Roy L. Derosia, Pittsfield, Mass.*

Paper Cutout Proportions Weight of Torch-Cut Steel

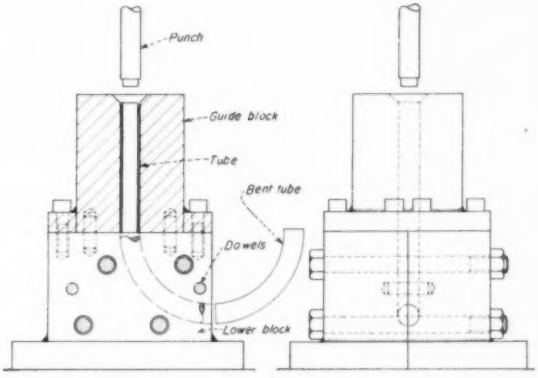
WHEN you have to cut out an irregular shape from steel plate with a torch, it is often necessary to be able to estimate the weight of the cutout before the job is started. A quick and easy way to do this is to make a scale drawing of the part on a piece of paper. Then cut the shape out and weigh it on a precision balance. By proportioning the weight of, say, a square foot of the paper to a square foot of the plate, you can figure out the final weight of the part. *V. H. Jackson, Cleveland, Ohio.*



Bent Tube Unkinks Wire

Here's a way to straighten out coiled or kinked wire when it is needed in a hurry. Take a 10-in. piece of steel tubing (brass or copper works, too) with an ID of about five times the wire diameter and bend it smoothly to the shape illustrated. Keep the ends in a straight line.

Hold the tube in a suitable lathe collet or chuck, run the lathe at about 800 rpm, and feed the wire slowly through the tube. For short straight pieces, grasp the wire with a drill chuck mounted in the tailstock, pull back the tailstock, cut the wire near the collet, and repeat. For longer pieces, feed the wire into the front end of the tube and pull it out through the rear end of the headstock as needed.



Press Tool Bends Tubing

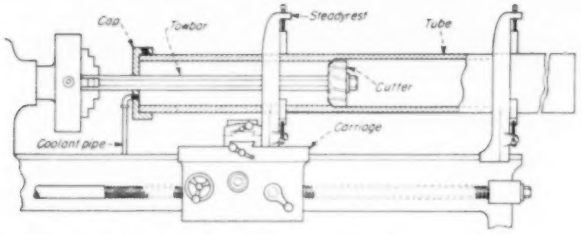
OFFICE FURNISHINGS have to be made of steel tubing that is free of wrinkles and imperfections, but sometimes it is difficult to bend the tubing with perfect results. We found that a press tool we tried did a good job and produced 60 pieces per hour.

Two parts made up the die—a straight upper section, and a lower section that was made of two half sections that were machined separately and screwed together. The tubing had 16-gage walls and was ⅝ in. on the OD. Correctly cut lengths were dropped into the upper straight section of the die, the press ram was lowered, and a tube was forced out of the lower section. After the first stroke in a run, the operation was continuous with a tube in the straight section displacing one in the curved section at each stroke.

The upper-block hole was about ten thousandths larger than the tubing so the parts would not jam, and the punch cleared by three thousandths. The upper block was made of hardened mild steel.

The curved hole in the lower block was cut with an end mill ground to a semicircular profile. The hole in the blocks of hardened die steel was polished to avoid scoring of the tubes.

A heavy lubricant was used by dipping the tubes in it before the operation. The machine was a screw-type press that forced the tubing through at constant velocity. *F. E. Riley, London, England.*



Cutter Rig on Engine Lathe Bores Long Tubes Smoothly

LARGE-QUANTITY PRODUCTION of beryllium-copper tubing was handled by boring tubes on a lathe with a helical milling cutter. The tubes were 48 in. long, had a $3\frac{1}{2}$-in. OD and a $2\frac{3}{4}$-in. ID. The internal dimension had to be enlarged to 2.890 in. with a tolerance of two thousandths.

Tooling requirements were two steadyrests, the cutter, and a long towbar that slid inside the machine spindle and was fitted to the cutter at the other end. A standard 3-in. cutter was cut in half to provide two cutters, and both disks were ground to the 2.890-in. diameter. The cutting edges were ground off at a 45° angle for a $\frac{1}{8}$-in. length.

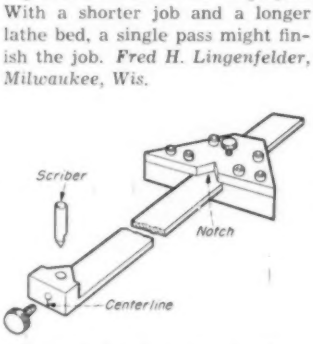
A setup was made with the front rest clamped to the lathe carriage and moved close to the chuck. The rear rest was clamped firmly to the ways of the machine. A tube was pushed into the rests, and the front rest was clamped down on it. Pieces of emery paper between the jaws of the rest and the tube insured good friction. The rear rest was adjusted so the tube would slide through it with no play.

Coolant was provided to keep down heat and wash out the chips by a fitting on a cap that was attached to the headstock end of the tube. Then the towbar and cutter were placed for the cut.

The bar was clamped in the chuck with the cutter close to the end of the tube. Hand power moved the carriage until the tube touched the cutter and centered it, then the chuck was started and power feed engaged. The cutter worked at 65 sfm, and the feed was about 0.017 in. This action revolved the cutter inside the tube as the carriage moved the tube toward the tailstock end of the lathe.

When the front rest got within about a foot of the rear rest the feed was stopped and power shut off. Then the tube was backed up to the chuck again, the towbar released and pushed into the spindle until the cutter was near the place where it had stopped cutting, and the bar was again clamped in the chuck. This process was repeated until the job had been completed.

Because the bed of the machine was only 3 ft long, this method of adjustment had to be employed. With a shorter job and a longer lathe bed, a single pass might finish the job. *Fred H. Lingenfelder, Milwaukee, Wis.*



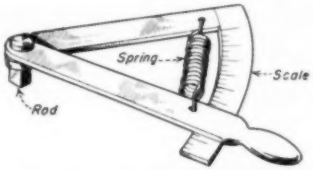
Layout Tool Can Be Used With Precision Gage Blocks

A PRECISION LAYOUT tool that can be used by many toolmakers, machinists, and inspection personnel is illustrated. It was made especially for locating hole centers for boring and drilling work.

The main arm and both sections of the squared head were made of pack-hardened machine steel, and the scriber, which is ground on one side to the centerline, was made from tool steel. The scriber is held in a vertical hole in the end of the arm by a small thumbscrew.

A notch in the head matches a tooth in the end of the arm so alignment and position can be easily checked by inspection. The head was made with a top plate and a lower plate notched around the arm. The fit here was made close enough to eliminate any wiggle.

Precision layout work is done by setting gage blocks between the half-section scriber and the face of the head and then transferring this dimension to the work. A centerline matching the center of the scriber point was scribed on the end of the arm for convenience. *Allan B. Nixon, Springfield, Mass.*

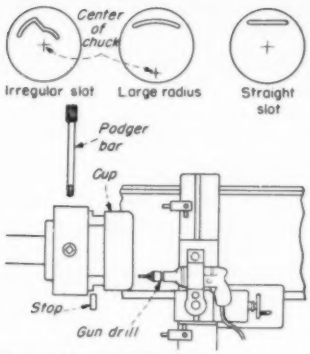


Simple Torque Wrench Made From Scrap-Steel Parts

EASILY MADE and requiring only a good spring besides scrap-steel parts, the illustrated torque wrench can be used with a standard set of socket wrenches.

A short piece of rod is milled square at one end to fit the socket holes, and is left round at the other end. It is welded into the flat fixed arm, and freely supports the free arm, which has a handle formed or the end. The spring, a tensio type, is chosen for the torque requirements.

The sheet-metal scale attachec to the fixed arm is calibrated by clamping the wrench in a vise and hanging various weights from the hole that anchors the spring. For each different weight, the wrench must be adjusted in the vise so the spring lines up vertically to provide a true indication on the arm. *Gerhard Wenke, Los Angeles, Cal.*



Hand-Gun Drill Mills Curved, Irregular Slots

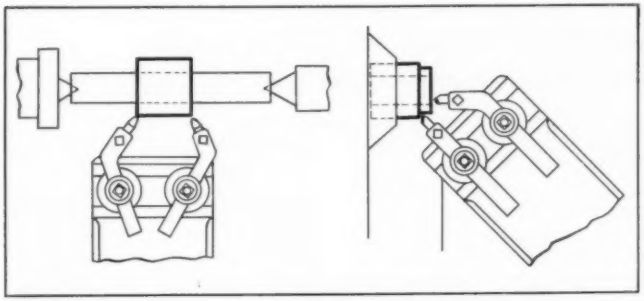
LIGHT-ALLOY CUPS for a spinning machine were slotted quickly and accurately with a setup of a drill gun mounted on a lathe carriage. The slots were irregular and consisted of radial slots merging with semi-circular slots.

The gun was fitted with a small milling cutter of the right size, and was clamped on the lathe slide with the spindle at right angles to the machine ways. An independent-jaw chuck gripped the cups internally.

For a curved slot concentric with the outside of the cups, they were chucked on center, the gun was advanced by means of the saddle, and the chuck was rotated by a bar screwed into a chuck-adjustment key. Straight cuts starting from curved ones were made by turning the chuck so the cut could be made horizontally by advancing the slide. Extra-large radii and radii that were off center were cut with the cups clamped off center in the four-jaw chuck.

Production runs were speeded by stops located on the carriage to halt the carriage and by stops located near the chuck which contacted the chuck jaws or the podger bar.

Many odd-shaped slots can be cut in a similar manner. This type of setup is usually easy to make and can be quickly lined up for production runs. *Dan Penway, Cumberland, England.*



Two Toolposts Double Cutting Power

I COULD NEVER understand why an extra toolpost was not standard equipment with an engine lathe, because it can increase the versatility of the machine tremendously.

A set of two toolposts can be set up beside each other in a standard cross-slide. When used with bent toolholders, these have many applications—two are shown.

In the example at the left, the left-hand toolbit is used for finish-turning the part and also for facing off the left-hand end. The right-hand toolbit is spaced so it will finish-face the right-hand end.

Another example at the right shows a toolbit facing and turning a shoulder while a second bit faces off the end of the drilled part.

Admittedly the tool setup for two toolposts would take more time, but on production runs the extra time would be more than compensated for. *Lyle C. Vinger, Waukesha, Wis.*

$25 *In addition to regular payment*

for the best PRACTICAL IDEA

An extra payment of $25 will be made for the best Practical Idea in each number of *American Machinist*. To avoid bias, the selection will be made by readers, a different group each time.

PAYMENT—$25 in addition to regular rates for the item as published, to be paid as soon as reader votes are received—usually three to four weeks after the date of the issue. The winner will also be announced in these pages as soon thereafter as practicable.

JUDGES — A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in tie, $25 will be paid to each and every co-winner. Decision of the readers will be final in each case.

REQUIREMENTS—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

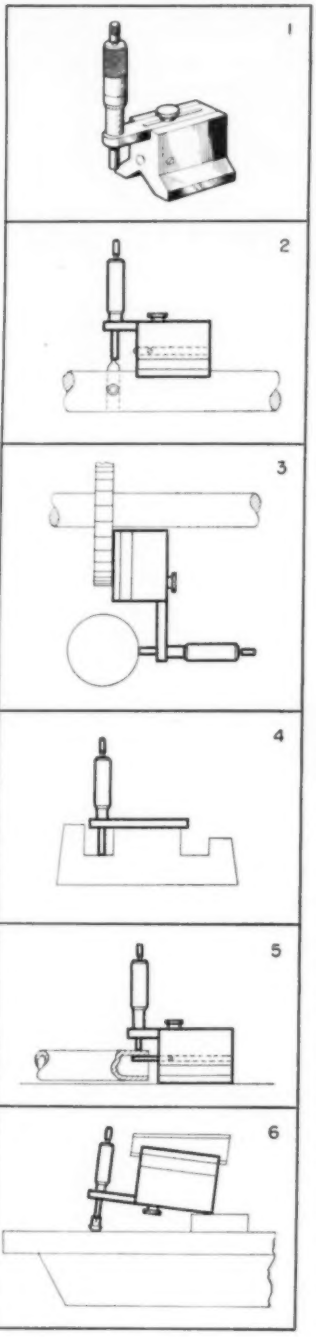
WHO MAY ENTER — Anyone may enter except employees of the McGraw-Hill Publishing Co., Inc., and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER—Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42d St., New York 18, N. Y.

80th Winner:

Allan B. Nixon

Special Angle Plate

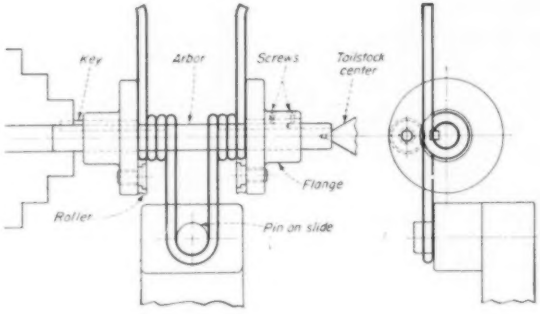


Micrometer Tool Puts Old Measuring Head to Use

A HEAD from a worn and useless micrometer was fitted to a V-block tool that made a versatile measuring device out of the assembly. This tool, with some of its applications, is shown at the left.

The main block, the sliding arm, and the horizontal rod were all ground accurately to shape, with sides at true right angles. The horizontal hole in the block was located so the head would read zero when the spindle was brought down on a rod in it. A fairly large thumbscrew was located in the center of the block to lock the arm.

The illustrations show (1) the completed tool, (2) setting a boring toolbit, (3) centering a milling cutter for a keyway cut, (4) measuring depth with the V-block removed, (5) measuring a tube wall, and (6) indicating a taper with the arm inverted in the block. There are many other applications of the device. *S. Framurz, Bombay, India.*



Double-Flange Winding Arbor Finishes Heavy Springs on Lathe

THE ILLUSTRATED TOOL solved a tough spring-winding job where U-shaped wire had to be formed at each end. The spring stock was 5/16 in. in diameter.

Two flanges were carried on a hardened arbor by keys. The left-hand key was fastened permanently to the arbor by means of screws (not shown) and bore against a chuck jaw while the arbor was clamped by the chuck. The right-hand key was screwed to the right-hand flange so the flange could be moved out and off the arbor. Clamping by the chuck was rigid enough to allow moving the tailstock out of the way so the finished spring and right-hand arbor could be taken off.

A pin mounted on the cross-slide of the lathe was used to anchor the already-formed loop of the spring, and the flanges were moved in so the two radius-formed rollers could catch on both ends of the stock. Power was engaged and the arbor revolved the rollers until the correct number of coils had been formed. During this forming cycle the center loop remained in the same position on the pin and the two flanges moved out to each side. The power was disengaged when the spring was formed, the tailstock was backed off, and the flange and spring were removed. The flange was then replaced on the right-hand end of the arbor, the tailstock moved up, and the cycle repeated.

The tooling was inexpensive to make, and had the advantage of no loose parts to get lost. Positive drive was provided to the arbor through the left-hand key which contacted a chuck jaw. *J. R. Paquin, Worcester, Mass.*

NEWS OF METALWORKING

$200 Million in Tools and Machinery To Be Bought in '50 by ECA-Europe

By SEABROOK HULL
(McGraw-Hill Washington Bureau)

WASHINGTON—The outlook for European purchases of American machine tools is good while ECA is still around to pick up the check. Odds are that during the coming fiscal year, 1950 exports to ECA-Europe of machine tools and metalworking machinery will come close to the $200-million mark—better than $75 million for machine tools and over $100 million for metalworking machinery. This fiscal year will be the high point in postwar western European buying of these items from the U.S. After that it will begin to taper off.

Attempts are being made to supply U.S.-type machine tools from European production in some cases through licensed production of the actual product—in others, through the time-honored practice of straight copying. However, effects of this sort of thing won't be felt right away. It takes time to set up production. In the future, it will mean some loss of market.

If, after ECA aid ends, Europe's dollar purchasing power is still restricted, standard living items will be the first to feel the pinch. However, dollar buying of industrial items will also be curtailed. Machine tool and metalworking machinery purchases will be limited only to those items that can't be procured in Europe, or in other soft currency areas. Marshall Plan country industries will be forced to put up with second-rate machine tools in most cases even though they will still prefer the American product.

$384.1 Million for Machine Tools

The bulk of Marshall Plan Europe's machine tool production plans for 1949-50 can be outlined as follows: Austria, $4.6 million; Belgium, $35.5 million; Netherlands, $9 million; France, $80 million; Italy, $79 million; United Kingdom, $140 million. Total: $384.1 million.

This figure compares with a total machinery and equipment production estimate for ECA-Europe of $5,910 million for 1949-50, against $5,460 million estimated for 1948-49 and $7,370 million estimated for 1952-53, the first year after ECA is planned to end.

(Turn to next page for the tabular material on how Marshall Plan countries plant to distribute the U.S. machine tools they hope to buy in 1949-50, and estimates of machinery and equipment buying plans as submitted to ECA by Marshall Plan countries.)

Sperry Grants What Union Calls 'Best Pension Plan'

NEW YORK — Sperry Gyroscope Co. has granted a CIO union what the union calls "one of the best pension plans found anywhere in the industry."

The contract with Local 450, CIO Electrical Workers, allows workers to retire at 65, after 25 years' participation, on 71 percent of their weekly pay. Employees, currently averaging $66 a week, contribute only about one hour's pay a week to the fund.

The contract also includes sick leave, life insurance, disability and health benefits and a $5 wage increase.

Negative Gradient Spring Has Uniform Resistance To Pull

LANSDALE, PA.—A steel spring has been recently developed which resists less the farther it is pulled. In another version, the pull required remains unchanged regardless of the distance. Springs normally increase their resistance to pulling the farther they are stretched.

This spring is in the form of a ribbon, similar to a typewriter ribbon, and is manufactured by Hunter Spring Co., Lansdale, Pa.

JAMES D. CUNNINGHAM, president of Republic Flow Meters Co., Chicago, will head the American Society of Mechanical Engineers in 1950, having been nominated at the ASME meeting in San Francisco June 27-July 1

Large Increase Shown in Contracts For California Aircraft Industry

LOS ANGELES—With the aircraft industry going through its greatest peacetime expansion, production and backlog figures are rapidly outdated. However, statistics available late in June showed that six major aircraft manufacturers in the Los Angeles area (Douglas, Lockheed, North American, Northrop, Consolidated, Ryan) will share this year in $1,217,345,000 worth of contracts—$429,165,000 more than were obtained last year.

Small business firms (with fewer than 500 employees) in the area also will participate in the aircraft program. Oscar A. Tripett, chairman of the Air Force Affairs Committee, revealed that more than $54,000,000 in contracts and sub-contracts has been awarded to the little firms, most of which manufacture components going into aircraft.

Air Materiel Command, the procurement agency for all Air Force needs, added that these smaller companies are to receive additional contracts as the country builds up and maintains a modern air force.

Total employment to date for the six large companies in the area is 66,500.

On the production side, the ledger shows Douglas with a contract for 412 various type aircraft; North American, 1,001; Lockheed, 895; Northrop, 48, and Consolidated, 114. No figures are available on Ryan production, which is building a few Navions for liaison work and some for consumers. Its main activity is making parts.

RFC Assists Machinery Makers Finding Loans Difficult to Obtain

WASHINGTON—Metalworking machine makers that can no longer finance themselves through regular credit channels have been hurrying to the Reconstruction Finance Corp. That's why RFC's business has been booming. Most of the electrical equipment manufacturers and other applicants are getting loans. So RFC's volume is away out front of its earlier postwar business.

Through the last three months for which figures are available—February, March and April—applicants for RFC loans from all industry average 838 a month—about 40 per cent above the monthly average for all of 1948.

In dollar terms, the rise has been even sharper; borrowers are now asking for twice as much as they did last year—about $120 million a month. Metalworking machine makers alone have asked for 18 loans during the same months. The total amount involved was $1,614,000.

RFC was set up by Congress back in 1932 to act only as a lender of last resort. The corporation was specifically told not to lend to anyone who could get the money elsewhere; to qualify, an applicant has to show that he has tried to get a loan from his banker and has been turned down. So when RFC makes a business loan today, it implies that no one else will.

RFC Loan Doesn't Prove Bankruptcy

But just because a business is seeking RFC aid, it isn't necessarily heading into bankruptcy. Some firms in otherwise robust financial condition want new capital for legitimate expansion. And they don't think they can get it by security flotation—the market being what it is today.

Other firms have permitted growing inventories to tie up too much working capital. Though by no means insolvent, they are in urgent need of cash. But more and more the banks are saying no to their requests.

Commercial banks these days are refusing loans—even to customers of long standing—for a variety of reasons. Finance companies are doing a careful job of screening, too.

Here is a sampling of typical metalworking machine makers who recently brought their problems to RFC and got help.

Canfield Tool & Die Company—This Michigan manufacturer of dies and machine parts was granted a loan of $6,000 by the RFC, to be used for working capital.

Tryon Machinery & Tool Manufacturing Company—RFC has loaned $45,000 to this New Jersey manufacturer of machine tools and aircraft parts. $43,000 is to be used for construction and $2,000 to increase its working capital.

Carter Machine & Tool Company—A loan of $50,000 was granted to this manufacturer of models of farm machinery in Illinois, by the RFC. The loan is to be used for working capital and debt payment.

Le Maire Tool & Manufacturing Company—From RFC this Michigan company, which manufactures special machine tools, power units and gear chucks, received a loan of $100,000 for debt payment and to increase its working capital.

Heidrich Tool & Die Corporation—This manufacturer of body dies, of Michigan, has been loaned $300,000 by Reconstruction Finance, to add to its working capital, and for debt payment.

How ECA-Europe Will Distribute Machine Tools It Hopes to Buy in Next Fiscal Year

Industry	Value ($1,000)	% of Total
Agricultural Machinery	2,800	3.5
Transportation Equipment	25,800	34.0
Electrical Equipment	13,500	17.0
Iron & Steel Equipment, mining & petroleum equipment	7,650	11.0
Textile Machinery	2,650	3.5
Other, especially small general engineering	23,800	31.0
Total	**$75,400**	**100.0**

Estimates of Machinery and Equipment Buying Plans

(In millions Jan., 1949 dollars as submitted to ECA by Marshall Plan Countries. These are estimates only and are not corrected for price changes, reduced dollar availability, or other contingencies.)

	1948-49		1949-50	
	Imports from U.S.	Total Imports	Imports from U.S.	Total Imports
Power Plant Equipment	42.0	165.3	71.0	237.5
Mining Equipment	19.0	57.2	19.0	54.9
Petroleum Equipment	179.1	218.0	248.9	300.8
Iron & Steel Equipment	75.3	107.3	105.5	147.9
Wood Working Machinery	6.4	22.0	3.6	15.8
Machine Tools	56.1	115.8	77.0	166.0
Textile Machinery & Other Machinery & Equipment	341.3	907.2	381.0	1,094.3
Total	**719.1**	**1,655.9**	**905.9**	**2,017.1**
Grand Total, incl. inland transport & agricultural machinery	**983.5**	**2,416.7**	**1,132.5**	**2,603.3**

Some Specific Types of U.S. Machinery & Equipment Included in "Other" Listing Above

(Values are Millions of January, 1949 Dollars)

Type of Equipment	Value	Type of Equipment	Value
Pulp & Paper Machinery	9.9	Pipes, Fittings	10.2
Printing	9.6	Office Machinery	11.3
Foundry Equipment	5.3	Special Machinery for Chemical Industry	28.9
material for Food Industry	19.0	Special Machinery for Leather Industry	3.3
Electric Motors	2.4	Ball Bearings	10.3
Static Engines	4.2	Enameled Wire	1.3
Boilers & Parts	3.6	Textile Machinery	56.3
Excavators	10.7	Compressors	5.0
Bulldozers (incl. tractor & dozer)	15.4	Pumps	1.2
Earth Boring Equipment	5.1	Air Conditioning Plants	.3
Cranes, Other Lifting Machinery	7.7	Other	89.8
Total			**309.6**

MAGNETIC LOADING *device for centerless grinding of headed pieces consists of swinging magnet-arm operated by a small hydraulic cylinder linked to the controlled-cycle mechanism. Before the wheels close, the arm lays the piece on the workplate and is then de-energized to release the work. The wheels next advance, grind, reopen, and the piece ejected. Made by Arthur Scrivener, Ltd., Birmingham, England, the machine maintains work to within .0001 in.*

Metalworking Now New England's Most Important Industrial Activity

BOSTON—Metalworking has supplanted textiles as New England's most important single industrial activity, it was revealed recently by Frederick S. Blackall, Jr., president and treasurer of the Taft-Peirce Mfg. Co., Woonsocket, R. I.

Approximately 26% of the nation's machine tool plants are located within the region, he pointed out, and despite New England's loss of textile spindles to the South, New England still produces something like 60% of the nation's textile manufacturing equipment, Mr. Blackwell added.

Based on 1947 figures, New England iron and steel products account for 8.2% of the nation's employment in this line; non-ferrous metals and products, 19.7%; electrical machinery, 14.84%; machinery other than electrical, 13.4%; aircraft, automotive, and shipbuilding, 8.52%. These industries, as a group, employ over 41% of New England's industrial workers.

The machinery industries alone—electrical and general—employ 22% of New England's industrial workers versus only 18.86% for textiles alone.

British Stamping Team Tours U. S.

WASHINGTON—A team from Great Britain's pressed metal industry is in the U.S. for a month's study of productivity methods in 15 American plants.

The ten-man team, which includes workers, technicians, and supervisors, is the fourth sponsored by the Anglo-American Council on Productivity in co-operation with ECA's Technical Assistance Div.

Team studies are designed to provide for an exchange of information on production methods in the two countries and to assist in Britain's recovery effort.

Among the plants observed by the group are: Worcester Pressed Steel Co., Worcester, Mass.; Morrison Steel Products, Buffalo; Federal Enameling & Stamping Co., McKees Rocks, Pa.; Ackerman Division of Wheeling Steel Corp., Pittsburgh; Mullins Mfg. Corp., Salem, Ohio; Fisher Body Division of General Motors Corp., American Stamping Co., Republic Steel Corp., Dickey-Grabler Co., all in Cleveland; Willys-Overland, Acklin Stamping Co., both in Toledo; Detroit Stamping Co., National Stamping Co., Detroit; Heintz Mfg. Co., Edw. G. Budd Co., Philadelphia.

New Corrosion Test Facilities

WILMINGTON, N. C.—Corrosion test facilities at the cooperative project in this area are being continually expanded. In addition to the test area at Kure Beach, a station for study of marine growth has been added at nearby Wrightsville Beach.

The Navy has transferred its salt-water corrosion research from the Naval Experiment Station to Kure Beach. In addition, equipment procured from the British station at Birmingham is now being installed. This will make it possible to compare directly results here and abroad.

Tests so far have shown that sea-water conditions cannot be simulated. Salt spray tests with 3% and 20% NaCl (common table salt), with synthetic sea water, and with actual sea water have shown there is no correlation between accelerated spray test results and the results from prolonged exposure to actual conditions.

Uniform Sea Water Corrosion

Comparison between tests here and at installations in other parts of the world have indicated that, aside from a small variation caused by temperature, the corrosive effect of sea water is uniform throughout the world. An exception is harbors where there is a great deal of local pollution.

One important development is the experiments with nickel plating of steel billets before rolling. This gives a nickel-rich surface that is holding paint much better than equivalent steels which were not plated before rolling.

Firms Cooperate in Tests

The Corrosion Testing Project, which started in 1935, is operated by the International Nickel Co. and Dow Chemical Co. Carnegie-Illinois Steel Corp. and American Rolling Mills Co. aided in setting up the equipment. Hundreds of companies have cooperated in supplying the test specimens. About 15,000 specimens are currently under test.

Mexican Steel Mill Gets Loan

MEXICO CITY (McGraw-Hill World News)—Mexico's largest steel mill, Fierro y Acero de Monterrey, has announced that it has obtained a loan of 11-million pesos (about $1.5 million) through a private financial and bonding house to begin an immediate enlargement and modernization program. The entire program will cost $2 million. The improved plant will be able to step up production of sheet iron products by 30,000 tons and will also be able to produce larger amounts of railroad equipment.

Here's How Military Screens Workers When Plants Take on Secret Jobs

WASHINGTON—Full details have now been revealed on the military's program for screening tens of thousands of workers in private industry for "loyalty" and "ability to keep their mouths shut" as a prerequisite to holding their jobs when management takes on secret work.

About one person in a thousand investigated is being denied the right to work on a classified job. Only 11 in 3,000 (average) ever are called upon to explain "derogatory information which prevents issuing a letter of consent (to work)."

Here is the investigating procedure:

The businessman is awarded a contract to make a classified item (restricted, confidential, secret, top secret) for the military. If work contains items under the top two classifications, his plant is immediately checked to see if it is secure—constructed in a manner to provide screening of secret work.

Employer provides local army zone commander with a list of all employees who in any way come in contact with classified work. The businessman doesn't get specifications for work until all his employees have been cleared, if he has work of top two classifications.

Every employee on both lists (those in secret work and those in top secret) are given a personnel security questionnaire to fill out. This asks a minute accounting of the employee's life for the past fifteen years.

Investigatory agencies next check the references and information given on the questionnaire. Reports on discoveries are returned to the Army zone commander. If there is nothing "derogatory" listed, a letter of consent is issued to the man and his employer.

If, however, something in the records, in the opinion of the Army commander, casts a doubt on the ability of the man to keep a secret, the case is automatically forwarded to the Military Personnel Security Board in Washington. The board studies the information, asks for more checks if necessary, and makes a decision. If the decision is unfavorable, the man may appeal to the Industrial Review Board in Washington.

The rejected person isn't denied the right to work in his plant or skill —he simply cannot work on the "secret" or "top secret" stuff.

Standards upon which the citizen's "security" is judged break down into two main categories of "subversive" and "other." "Subversive" includes records indicating that the individual has engaged in activities of espionage or sabotage or associated with others so engaged; public statements and writings encouraging seditious opinions or actions; sympathy for organizations seeking to alter our form of government by unconstitutional means; being under the influence of a foreign power to detriment of U.S.; sympathetic association with totalitarian movements; advocating force to bring about political, social or economic changes.

"Other" includes records indicating that an individual might be induced to act against U.S. interests based on the following: history of serious mental or emotional instability; conviction of felony in past 10 years; basic weakness of character; records of an unauthorized disclosure to anyone of classified material to detriment of U.S.

***MARINE GEAR** installation, designed to harness power of 12,500 hp cross-compound turbine, is swung aboard a tanker now in production. This G.E. double reduction gear unit translates thousands of rpm of turbines into usable 112 rpm of the propeller*

Pressed Metal Institute Names Gorrell President

CLEVELAND—Walter A. Gorrell was elected president of the Pressed Metal Institute at the last meeting of the board of trustees. Mr. Gorrell retired recently as president of E. J. McAleer Co., Philadelphia, and, until recently was chairman of the Philadelphia district of PMI.

At the same meeting the board also undertook perfection of plans for the annual Cleveland convention.

Calendar of Events

SEPTEMBER

15-16 — Magnesium Assn., quarterly meeting; Statler Hotel, Detroit.

21-23—The National Assn. of Foremen, annual convention; Statler Hotel, Detroit.

26-28 — American Management Assn., personnel conference; Waldorf Astoria, New York.

28-30—American Society of Mechanical Engineers, fall meeting; Lawrence Hotel, Erie, Pa.

OCTOBER

4-6 — Industrial Packaging and Materials Handling Exposition, annual convention; Detroit.

10-14—American Society for Testing Materials, national meeting; Fairmont Hotel, Mark Hopkins Hotel, San Francisco.

13-15 — Foundry Equipment Manufacturers Assn., annual meeting; White Sulphur Springs, W. Va.

17-21—National Metal Congress & Exposition; Public Auditorium, Cleveland.

24-26—American Gear Manufacturers Assn., annual meeting; Chicago.

26-28—National Metal Trades Assn., annual convention; Palmer House, Chicago.

27-29—American Society of Tool Engineers, semi-annual meeting; Mt. Royal Hotel, Montreal.

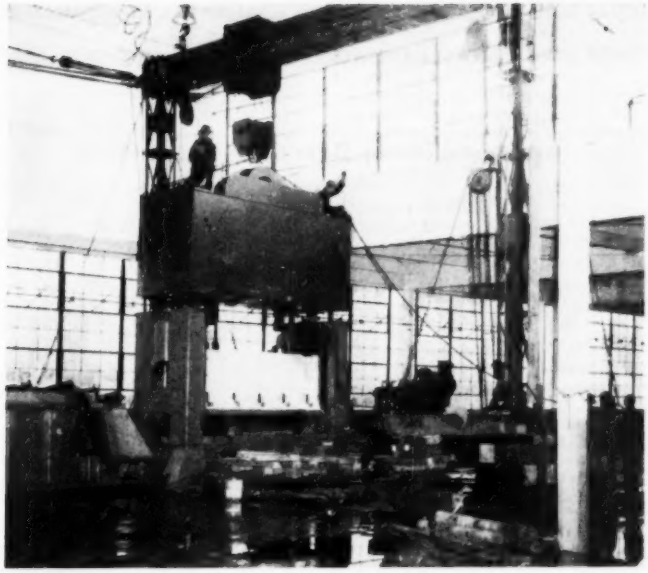
Annual Wage Is Long Way Off

WASHINGTON — Organized labor seems to have missed the boat on one of its major postwar objectives —the guaranteed annual wage. First steps toward this objective were taken during the war in the basic steel disputes.

Later, talk was that, if unions were to get a guaranteed annual wage, they had to get it while the country was in a period of full employment.

A report by the Latimer Committee appointed by FDR to study the problem, was submitted to President Truman in January, 1947, without recommendations. Truman passed it on to his Council of Economic Advisers, where it has been gathering dust.

Now unions are asking for shorter work weeks in order to spread the work among members. This shift in objective is due to the rising unemployment which handicaps unions in their attempt to get the annual wage.



***HUGE PRESS**, one of two Verson units, is established in new factory building of Nineteen Hundred Corp., St. Joseph, Mich., manufacturer of Whirlpool home laundry equipment. New department will eliminate former need to farm half of punch press work out of factory. Press department will occupy 28,000 sq ft.*

Shipyards Due For Business Boost If New Merchant Marine Act Passes

WASHINGTON—Better business for U.S. shipyards? It could be, if amendments to the Merchant Marine Act of 1936 now under consideration get Congressional approval.

The House Merchant Marine and Fisheries Committee, headed by Rep. S. O. Bland, (D., Va.), is now airing a plan bringing up to date the 1936 act. There's a good chance it will be passed.

If the bill is passed, chances of shipyard and drydock business picking up are good. It is estimated that at least 10 passenger vessels would be ordered. Also, tramp steamer operators would be eligible, like the liner services, for construction differential subsidies.

Here's what the program would do:

(1) It would give construction subsidies to all companies operating ships in foreign trade. That lets in the trampship operator. Now only the companies working the so-called essential trade routes get this break.

(2) It would give mortgage relief to a company buying a new passenger vessel by making it liable only to the extent of that one ship. Under the present system, a company defaulting on a government loan risks all its assets.

(3) It would reduce the minimum age at which shippers can trade in old vessels to the Maritime Commission to 12 years. Now an owner can turn it back to the commission only after it's reached an age of 17 years, three years before its 20 obsolescence period expires. Under the present system all of the war-built merchant vessels would become over-age at once, causing a great rush on shipbuilding facilities. The 12-year limitation would allow this new construction to be spread out over a longer period.

(4) It would make construction reserve funds tax exempt, and liberalize their use with Maritime Commission approval. The plan would let companies use them to recondition ships and to liquidate debts.

(5) It would allow companies to up depreciation rates to as high as 15% in good years, instead of the present 5% limit.

(6) It would permit the Maritime Commission to recompute the life of a reconstructed vessel for depreciation purposes; it's now fixed at 20 years. Reconstruction cost usually runs into millions, an expense the owner cannot amortize under present rules.

No Labor Law For This Session

WASHINGTON—It is practically certain that no new labor law will pass Congress this session; indeed, chances are slim on a new effort to rewrite Taft-Hartley until after the 1950 Congressional elections.

Representatives have little stomach for another battle. They give two reasons: (1) Sen. Taft's victory in the Senate makes clear the outlines of any new law and labor is completely unsatisfied with Sen. Taft's bill; (2) Mr. Truman would veto anything the representatives can get voted.

The fact that Sen. Taft refuses to change the philosophy of T-H is what makes unions oppose every line of his rewrite. And the difference between T-H and the substitute the Senate voted recently are those of mechanics and detail, not of philosophy. Sen. Thomas and labor want a "Labor Relations Act"; Sen. Taft wants a "Labor-Management" Act.

Some Changes Noted

Here are some of the changes in Sen. Taft's bill that do soften T-H appreciably, as to mechanics and detail: In exempting foremen from NLRB recognition, the new Taft bill rules a worker as foreman only if he actually is management's straw boss; a union would be responsible only for the acts of its authorized agents; the office of independent counsel—Robert Denham's job—is eliminated, and the legal side of the NLRB is brought within the rules of other quasi-judicial government agencies; though the closed-shop ban is retained, a preferential hiring hall is permitted; union-shop elections are eliminated; one kind of secondary boycott is authorized—the kind that permits unions to refuse to handle "struck work."

Injunction Issue Changed

Mandatory action on the part of the NLRB in seeking temporary injunction in unfair labor practices cases is changed to give the board injunctive power only if it wishes to use it; joint control of welfare funds is not necessary if the employer doesn't want it; check-off of dues is permitted from year-to-year so long as the rank-and-file don't reject the check-off; unions are permitted to make political expenditures—buy advertising, put out political pamphlets and so forth—but union contributions to a candidates' campaign fund are still prohibited; workers on strike are returned the right to vote in any subsequent union recognition elections—T-H had been interpreted to deny the vote to men whose jobs had been filled.

The next labor debate will find these questions back again.

Detroit

PREWAR AUTO RATIOS BEING RESTORED . . . BUSINESS FOR PRESS MAKERS AT NEW FORD PLANT . . . NASH WORKS ON ITS OWN AUTOMATIC SHIFT

The significant big news to study as steel loosens (giving auto manufacturers all the requirements they need), and as the car and truck market approaches a time when selling rather than order-taking determines volume, is how the prewar ratios between manufacturers are beginning to be restored.

The most notable statistics are those dealing with the position of the "Big Three" manufacturers and the so-called independents. A year ago and more the independents were floating along in an idyllic situation. They were handling far more than their historic share of the market, and selling everything they could build. For all of 1948 they had 21.6% of the total U. S. and Canadian car business, on the basis of the production figures of Ward's Reports, Inc. (see table).

But even that 21.6% held within it the seeds of decline. During the first half of 1948 the independents were doing 23.76% of the total business. They had fallen off practically 2½ percentage points by year's end.

Decline of Independents Continues

Their decline has been continuing. For the first three months of 1949, their business was 21.32% of the total. For the full six months, just compiled, their ratio was 17.19%.

The industry's powerhouse, General Motors, has reaped most of the benefit. GM has been steadily improving its relative and actual position this year. Where during all of 1948 its percentage of the industry was 37%, plus a scattering represented by its Canadian operations, in 1949 it has built 41.87% of the total in the initial six months.

Ford's level, too, has improved proportionately, although the May strike impaired its position. But last year its percentage of the industry was 18.95% plus the output of its Canadian affiliate. During the first three months this year it garnered 21.82%. That ratio fell off to 18.27% when the full 6-month figures came in, due to the May-June shutdowns caused by the Rouge walkout, but the trend line is fairly evident. Chrysler, too, has been hurt by an epidemic of wildcats in its own and supplier plants, but has about held its own notwithstanding.

During June General Motors built the highest number of vehicles in its history. The totals: 229,564 passenger cars, 46,139 trucks. This was the second record-shattering month in a row; May's total was 265,280. By comparison, the average month in 1941 was less than 200,000, and the peak was 262,628.

Auto Production—by Major Manufacturing Groups

(percentages)

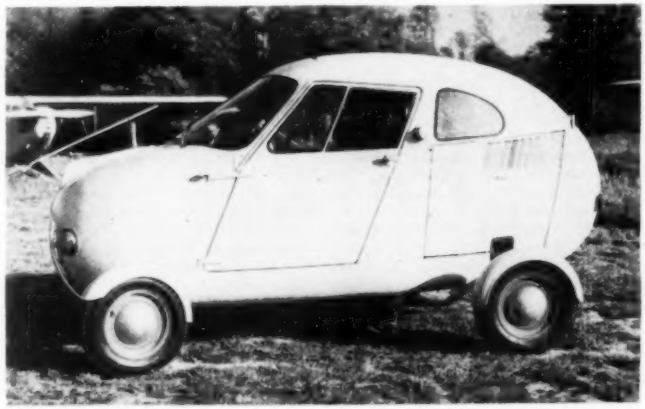
	1948				1949	
	Three Months	Six Months	Nine Months	Twelve Months	Three Months	Six Months
General Motors	38.18	38.24	38.39	37.00	38.35	41.87
Chrysler	17.21	16.90	17.20	18.00	16.86	18.21
Ford	17.84	16.20	18.13	18.95	21.82	18.27
Big Three	73.23	71.34	73.72	73.95	77.03	78.35
Independents	22.21	23.76	21.67	21.32	19.23	17.19
Canada	4.56	4.90	4.61	4.73	3.74	4.46

Chevrolet, the volume leader of the industry, also set an all-time record in June, building 151,466 vehicles, of which 34,851 were trucks. During the first six months of 1949, total Chevrolet output stands at 731,795, despite a model changeover at the start of the year. Figures like this are reminiscent of the historic levels of Ford in the late twenties, when that producer was building up to 1,500,000 vehicles a year and more.

Ford, incidentally, should be a good prospect for press makers to call on these days. The company will begin building before long a new stamping plant at Hamburg, N. Y., on the outskirts of Buffalo, where it already has an assembly plant. There are no details as yet available on the new pressed steel shops, first to be operated by the company outside of the Rouge. However, it is expected that they will take a substantial amount of work back into the company which has hitherto been farmed out to suppliers. This gives good indication that the equipment for the new plant will come new.

Talk of small cars still persists, with evidently good grounds. Nash is supposed to have a prototype model built, with wheelbase of approximately 100 in., for field test purposes. There have been no releases for equipment yet, however, which means that the project is not finalized by any means. The only releases rumored out of Nash are some revamping of rear end sheet metal.

Nash is understood to have closed a deal like Ford did with General Motors, providing for the licensing of the Hydra-Matic transmission on forthcoming models. That company, nonetheless, is continuing work of its own aimed at producing an automatic shifting mechanism which would sell in considerably lower ground than the Hydra-Matic.



***AUTO PORTION** of first Aerocar constructed at Longview, Wash., by Aerocar, Inc. Work on flying component is now under way. Car weighs 800 lb and runs on the road at an average of 45 mph. The drive line is a Crosley installation*

Names in the News

Sands G. Falk

Sands G. Falk has been appointed manager of foundry sales for The Falk Corporation, Milwaukee. He succeeds **John S. Wilkinson** who becomes foundry sales consultant.

John R. Cary has been appointed sales manager of the Browning Crane and Shovel Co., Cleveland, succeeding **William H. Waite,** retired.

John J. Radigan has been appointed director of industrial relations for E. W. Bliss Co. plants in Salem, O., and Hastings, Mich.

Robert F. Hodgson has been appointed chief engineer of Hydraulic Equipment Co., Cleveland. He has been with Hydreco for four years in the sales and engineering departments.

R. G. Caulley has been named vice president in charge of sales for Peninsular Grinding Wheel Co., Detroit. He was formerly general sales manager for the company.

T. H. Keating, general sales manager since 1945, has been named general manager of the Chevrolet division of General Motors Corp., Detroit. He succeeds **W. F. Armstrong.**

James F. Clark has been elected treasurer of American Car and Foundry Co., succeeding **Lester A. Blackford,** retired.

Theodore B. Focke, general manager of the airplane division of Curtiss-Wright, has been named vice president and general manager and director of the engine building division, Wright Aeronautical Corp., Woodridge, N. J. **H. Fletcher Brown,** factory manager of the airplane division, has been named to succeed Mr. Focke.

Emil Buban has been named factory supt. of Detroit Harvester Co. He has been with the company ten years as toolmaker and later as general foreman.

Newton D. Baker III, secretary of Cleveland Bronze Graphite Co., has been made executive vice president of the Harris Products Co. He will also continue as secretary of Cleveland Graphite Bronze, which in May acquired ownership of Harris.

Walter W. Rector, formerly executive vice president and general manager, The American Fork and Hoe Co., Cleveland, has been elected president of True Temper Corp., new name of American Fork and Hoe Co. **A. F. Fifield** was elected chairman and **J. C. Goddard** elected to the board. Other changes: **G. E. Dickinson,** vice president, labor relations; and **B. L. Brockelhurst,** controller.

T. M. Robie has been appointed director of quality control for Fairbanks, Morse & Co.'s Beloit Works, Beloit, Wis. He has been succeeded by **J. W. Wright,** who was manager of the company's diesel engine and sales department at the Kansas City branch.

Gen. Brehon Somervell, president of Koppers Co., Inc., Pittsburgh, was elected a member of the board of the Carborundum Co., Niagara Falls, N. Y. He was retired from the Army in 1946.

Alan Stubbs, assistant sales manager and foreign sales manager of Bryant Chucking Grinder Co., Springfield, Mass., has been named general sales manager, succeeding **Walter M. Smith,** retired.

***CECIL M. PETER** (top) and **LEROY C. KING**, vice president and general manager, and sales manager, respectively, of The Fellows Gear Shaper Co., Springfield, Vt. Their appointments were reported in A.M., July 14.*

F. E. Schuchman has been elected president of Homestead Valve Mfg. Co., Coraopolis, Pa. He also holds titles of general manager and treasurer. **W. R. Schuchman** was named chairman of the board after 28 years as president. **J. E. Roth,** former board chairman, was named chairman of the advisory committee. Other officers named: Bradley McCormick, secretary and N. E. Kolesar, assistant treasurer.

***ROBERT S. FLESHIEM** (left) assistant to the executive vice president, general Machinery div., Allis-Chalmers, Milwaukee; and **J. D. GREENSWARD**, general manager of the company's Norwood, Ohio, works. Their appointments were reported in A.M., July 14.*

E. R. Oeschger has been appointed manager of the recently formed foundry division of the Apparatus Dept., General Electric Co., Schenectady, N. Y. Former co-ordinator of foundry operations, he will be in charge of the operation and management of personnel and facilities, as well as development, improvement and production of foundry products.

Clyde C. Randolph has been appointed acting works manager of Western Electric's Point Breeze Works in Baltimore and works manager of the Tonawanda Plant in Buffalo and the Allentown, Pa., plant.

Business Items

Action Manufacturing Co., Philadelphia, has moved its shop and office from 1930 E. Letterly St. to 4567-71 Bermuda St.

American Brake Shoe Co. will close its 36-year-old Atlanta, Ga., branch July 31 because of lack of orders. Part of the plant equipment will be transferred to other plants and part of it will be sold.

Technical Metal Processing Inc., Cleveland, has moved to larger quarters at East 55th St. and Lake Court.

Hamilton-Thomas Corp., Hamilton, Ohio, has acquired The Smith & Mills Co., Cincinnati, Ohio. The company will be known as the Smith & Mills Division of the Hamilton-Thomas Corp.

Threadwell Tap & Die Co., Greenfield, Mass., has purchased the Conant & Donelson Co., Conway, Mass. Production has been transferred to the Threadwell plant.

Lindeteves Machine Tool Export Corp., New York City, has changed its name to Amlintool, Inc.

The Balmar Corp., Baltimore, has acquired the business of N. A. Strand and Co., Chicago. The business will operate as the N. A. Strand Division of the Balmar Corp.

The Sturgis Products Co., Sturgis, Mich., has changed its corporate name to Roto-Finish Co. and has moved all sales and manufacturing to its new plant at Kalamazoo, Mich.

The Schauer Manufacturing Corp. is the new name of the Schauer Machine Co., Cincinnati.

Dorman Machine Tool Works, Mt. Vernon, N. Y., has consolidated with the Thriftmaster Products Corp., Lancaster, Pa. Operations will be carried on in the Thriftmaster plant at Lancaster, Pa.

Obituaries

Clifford R. Ramage, 65, vice president and director of purchases of Diamond Chain Co., Inc., Chicago, died June 22.

William H. Bahan, 67, president and treasurer of Bahan Textile Machinery Co., Greenville, S. C., died recently

Ralph M. Bowman, purchasing agent of the refractories and alloys division of Republic Steel Corp., Cleveland, died June 18. He was a former director of the American Society for Testing Materials, a member of the American Institute of Mining and Metallurgical Engineers.

H. Kirke Becker, president of the Packaging Machinery Manufacturers Institute and president of Peters Machinery Co., Chicago, died June 21 aboard the S.S. Mauretania, shortly before arriving in England. He was a charter member of the Institute and assisted in its formation in 1933.

Edwin C. Shultz

Edwin C. Shultz, 51, advertising manager of Pratt & Whitney Div., Niles-Bement-Pond Co., West Hartford, Conn., died July 5. He joined the old Pratt & Whitney Co. 27 years ago.

Frank A. Conrad, 52, vice president of the Puget Sound Sheet Metal Works, Seattle, died June 24. With the company 36 years, he was in charge during the war of the company's plant which turned out wings, fuselage sections and other aircraft parts.

Harold Kinsey, 67, president of Cameron Machinery Co., Brooklyn, died in Brooklyn recently.

Elias A. C. Smith, 75, consulting metallurgical engineer with Guggenheim Brothers, died June 25. He was the holder of several patents and originator of the Guggenheim method of extracting nitrate from caliche.

Harold C. Bullard

Harold C. Bullard, 69, plant engineer of The Bullard Co., Bridgeport, Conn., died June 28. In 1904 he became associated with The Bullard Co., which his father founded, and left shortly thereafter to take an engineering position with the Berlin Bridge Co., Berlin, Conn. He was later employed by F. W. Robinson Co., New Haven, as supervisor of engineering. Later he became manager of outside work for the Concrete Block & Construction Co., Bridgeport. He returned to Bullard in 1912 as a member of the mechanical engineering dept., and in 1921 was made plant engineer.

Eli A. Round, 76, vice president and production expert at Cleveland Chain & Mfg. Co., died July 8. Mr. Round, a national authority on chain methods, was active with his cousin, the late Louis D. Round, in forming the company.

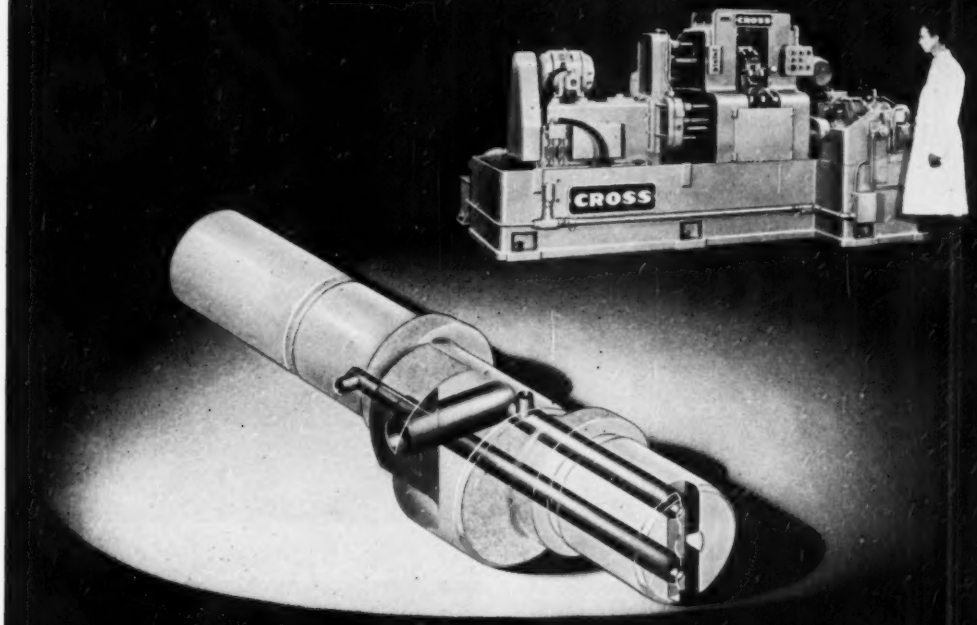
Arthur Dockter, general superintendent of De Laval Steam Turbine Co., Trenton, N. J., died June 20.

George W. Kemp, 61, pioneer machinist, died recently. He had been honored by the Smithsonian Institute when it accepted for permanent display an aircraft engine he designed in 1910.

Sidney G. deKay

Sidney G. deKay, 68, vice president and director of Olin Industries, Inc., New York, died June 21.

Another Special by Cross



Drills and *Mills* Refrigerator Crankshafts at *Less Cost* per Piece

- ★ 145 pieces finished per hour at 100% efficiency
- ★ 12 station automatic index trunnion for drilling five holes
- ★ Two deep oil holes drilled progressively—one in three stations and the other in six stations
- ★ Two milling operations performed by automatic unit independently of drilling

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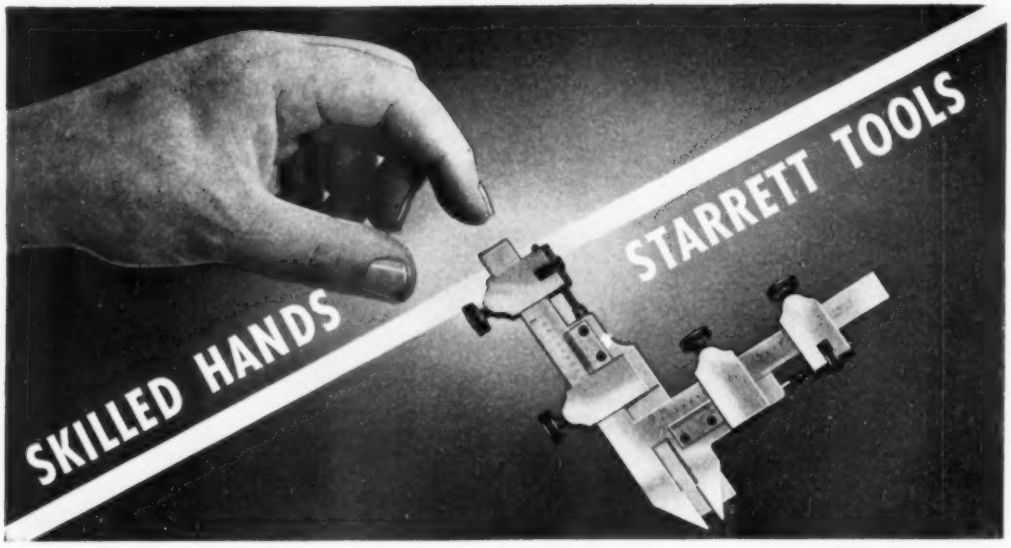
DETROIT 7, MICHIGAN

SPECIAL MACHINE TOOLS

MILLING • DRILLING • TAPPING • BORING • TURNING • SHAPING • GRINDING • HONING

AN UNBEATABLE COMBINATION...



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Threading Speeds for Various Materials

COURTESY LANDIS MACHINE COMPANY

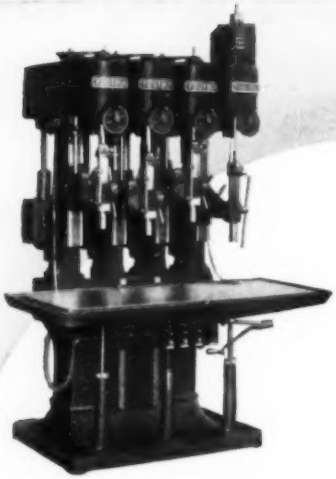
NATIONAL COARSE THREADS

	MATERIALS											
	TOOL STEEL (CARBON)		VANADIUM STEEL STAINLESS STEEL FORGED STEEL OPEN HEARTH MONEL METAL		MACHINE STEEL DRAWN STEEL TOBIN BRONZE BESSEMER SCREW STOCK		MALLEABLE IRON CAST IRON		CAST BRASS BAR BRASS PHOS. BRONZE COPPER		FIBER BAKELITE ALUMINUM LEAD	
DIA.	RPM	SURFACE SPEED	RPM	SURFACE SPEED	RPM	SURFACE SPEED	RPM	SURFACE SPEED	RPM	SURFACE SPEED	RPM	SURFACE SPEED
1/4	306	20	535	35	764	50	917	60	1070	70	1222	80
5/16	245		428		611		733		856		978	
3/8	183	18	306	30	458	45	560	55	662	65	764	75
7/16	157		262		393		481		568		656	
1/2	137		191		306		382		459		535	
9/16	102	15	170	25	272	40	340	50	407	60	475	70
5/8	92		153		245		306		367		428	
3/4	76		102		178		229		279		330	
7/8	65		87	20	153	35	196	45	241	55	285	65
1	46	12	76		134		172		210		258	
1 1/8	41		68		119		153		187		221	
1 1/4	37		55		92		123		153		183	
1 1/2	31		46	18	76	30	102	40	127	50	153	60
1 3/4	22		39		66		87		109		131	
2	19	10	29		48		67		86		105	
2 1/4	17		25	15	42	25	59	35	76	45	94	55
2 1/2	15		23		38		53		69		84	
2 3/4	11	8	21		35		49		62		77	
3	10		13	10	26	20	38	30	51	40	64	50

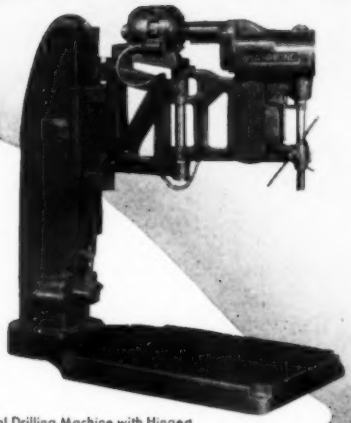
NATIONAL FINE SERIES

1/4	382	25	611	40	764	50	917	60	1222	80	1222	80
5/16	306		489		611		733		978		978	
3/8	255		357	35	458	45	611		815		815	
7/16	175	20	306		393		524		656	75	699	
1/2	153		268		344		459		573		611	
9/16	136		238		306		373	55	475	70	543	
5/8	122		214		276		337		428		489	
3/4	92	18	153	30	203	40	254	50	357	65	381	75
7/8	79		131		153	35	219		285		329	
1	69		115		134		191		258		287	
1 1/8	61		85		119		153	45	204	60	255	
1 1/4	46	15	76	25	107		137		183		214	70
1 1/2	38		64		89		115		153		178	
1 3/4	33		44	20	66	30	87	40	120	55	153	
2	29		38		57		76		105		124	
2 1/4	20	12	25	15	42	25	59	35	85	50	111	65
2 1/2	18		23		38		54		76		99	
2 3/4	17		21		35		49		69		83	60
3	15		19		32		45		64		76	

CUTTING SPEEDS LISTED ARE FOR ANNEALED STOCK ONLY. WHEN HEAT TREATED MATERIAL IS THREADED, DECREASE CUTTING SPEED 20 TO 30 %.



Built in 1, 2, 3, 4 and 6 spindle models, also as a tool room drilling machine, these sensitive drilling machines are accurate for the most exacting work and have the usual Footburt sturdiness of construction to make them suitable for continuous production line work. The above 4 spindle machine has tapping attachment and power feed attachment.



A Unique Radial Drilling Machine with Hinged Bracket that makes it possible to swing quickly from hole to hole over a wide area. A very convenient tapping arrangement is incorporated in this machine

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• The choice of fine machine tools is an investment for future profits when products have to be made with increased accuracy and efficiency. • These machines are built with the usual Footburt workmanship and sturdiness that will keep them accurate over a long period.

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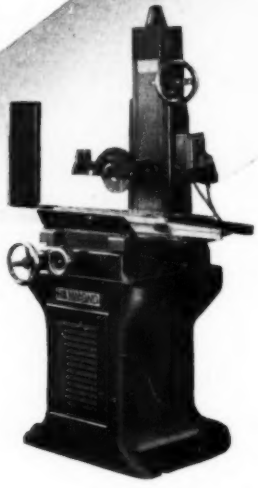

A very accurate 6" x 18" Hand Feed Surface Grinder especially adaptable for Tool Room Work and work on small, fussy pieces.

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MACHINE TOOLS

ENGINEERED FOR PRODUCTION

American Machinist REFERENCE BOOK SHEET

Finishing Treatments for Magnesium

BY JEROME L. BLEIWEIS, Metal Finishing Consultant

Sealed Chrome-Pickle Process

Purpose—To provide a corrosion-resistant coating or a paint base for magnesium and its alloys. Also to increase the corrosion resistance of chrome-pickled magnesium.

Nature of Coatings—Thin, electrically conducting, iridescent coatings ranging in color from matte gray, through yellow-red iridescent showing a pebbled etch under the microscope to smooth brassy and silvery white coatings. Chromates and dichromates are absorbed in the pores of the coating.

Treatment Procedure:

1. Clean magnesium alloy parts by degreasing or alkaline cleaning and rinsing.
2. Immerse for ½ to 2 min. at 70-90 F in:

Sodium dichromate	1.5 lb
Nitric acid	0.9 pint
Water	to make 1 gal.

3. Rinse in cold water.
4. Immerse for 30 min. in a boiling 10 to 15% sealing solution of potassium or sodium dichromate.
5. Rinse in cold water, hot water and dry.

Notes and Comments:

1. The treatment is also known as Dow Treatment No. 10 (Dow Chemical Co.), AMC-L (American Magnesium Co.), and An-M-12 Type II (Army-Navy Joint Specification).
2. Etching occurs during treatment. As much as 0.0006 to 0.001 in. of metal per surface may be removed. To minimize this, particularly on finish machined surfaces, the following dip for 15 sec. can be used in place of the solutions under "Treatment Procedure (2):"

Sodium dichromate	0.75 lb
Nitric acid	0.50 pint
Water	to make 1 gal.

3. The coating has low electrical resistance and is therefore useful where passage of current is required through mating parts.
4. The color, luster and paint-base characteristics of the coating are functions of the age of the coating solution, type of alloy and heat-treatment.
5. Sealing does not effect a very great increase in corrosion resistance of sand castings, but the increase for die-castings is considerable. By incorporating a preliminary 5-min. dip in a 15% hydrofluoric-acid solution before chrome-pickling, the corrosion resistance of sand castings is materially increased.
6. The *pH* of the sealing solution should be maintained at 4.0 to 4.4 by suitable chromic-acid additions.
7. The abrasion resistance of the coating is poor.
8. The chrome-pickle solution should be kept in stainless-steel tanks or acid-resistant stoneware crocks. The sealing solution can be held in ordinary steel tanks.

Anodic Treatment

Purpose—To provide magnesium and its alloys with a corrosion-resistant coating which is suitable as a paint base.

Nature of Coating—The coating produced is dark, particularly on sand and permanent-mold castings upon which the coating may be black. Die-castings produce coatings which are somewhat grayer in color.

Treatment Procedure:

1. Clean the work by vapor degreasing, followed by alkaline cleaning.
2. Rinse in cold water.
3. Pickle in a chromic, sulfuric or nitric-sulfuric acid pickle.
4. Rinse in cold water.
5. Immerse for 5 min. in a 15% hydrofluoric-acid solution at room temperature.
6. Rinse in cold water.
7. Anodically treat in the following bath and under the following conditions:

Sodium dichromate	13.4 oz
Monosodium phosphate	2.67 oz
Water to make	1 gal.
Current density	5 to 10 amp per sq. ft.
Tank voltage	3 to 6 volts
Temperature	122 F
Time	45 min.
pH	4.2 to 4.8

8. Rinse in cold water, hot water and dry.

Notes and Comments:

1. This treatment is also known as the Navy PT-13d process and Dow No. 13 treatment.
2. The coating formed is an excellent base for paint.
3. The corrosion-resistant qualities of the coating are excellent.
4. The process finds application on housing and on engine castings after assembly.
5. One disadvantage of the process is that its anodic throwing power is only fair. Portions of the work closest to the cathode are more completely anodized than the recessed portions.
6. The process finds its widest application on products made of Dowmetal H or AMC 265 alloys.

fastenings

machine parts

oil well parts

nuts

bolts

carburetor parts

valve parts

See what free-machining Stainless Steels offer

Toughness, hardness, good machinability, high abrasion resistance and good corrosion resistance . . .

These are among the advantages you get with the hardenable chromium types of Armco Stainless Steel bars and wire. These magnetic grades attain top corrosion resistance in the hardened and stress-relieved condition.

You can machine Armco 12 FM, Type 416, at speeds approaching 85% of those used for Bessemer screw stock. The special higher-carbon Armco grades, 13-C-35 FM (Type 420F) and Armco 17-C-100 FM (Type 440F) require somewhat slower speeds because of their hardness.

Their chemical and mechanical properties vary widely.

Properties after stress relieving are based on material having the as-quenched hardness listed here.

If your product-problem is corrosion or high strength, consider the advantages of solid rustless steels that never need plating or replating. And remember too, Armco Stainless Steels give you the plus values of sales appeal and customer-satisfaction.

Let's talk it over. If Armco Stainless isn't the most satisfactory, most saleable metal for you to use, we'll be the first to tell you so. Just write Armco Steel Corporation, 3299 Curtis Street, Middletown, Ohio.

Export: The Armco International Corporation

chemical analysis

Type	Carbon (Max.)	Manganese (Max.)	Chromium	Selenium	Molybdenum or Zirconium
416	0.15	1.25	12.0-14.0		0.60
420F	Over 0.15 to 0.45	1.00	12.0-14.0	0.18-0.35	
440F	95-1.20	1.00	16.0-18.0	0.10-0.20	

typical mechanical properties

Type	As Quenched Hardness		Stress Relieving Temp. °F.	Ultimate Tensile Strength, psi	Yield Strength 0.2% Offset psi	Elonga. in 2", %	Hardness	
	Brin.	Rock.					Brin.	Rock.
416	410	C43	600	180,000	140,000	13	375	C39
420F	540	C54	600	230,000	195,000	8	500	C50
440F	610	C60	500	285,000	275,000	2	580	C57

ARMCO STEEL CORPORATION

Pointers For Lower-Cost Designs

COURTESY GENERAL ELECTRIC COMPANY

Castings

1. Eliminate dry sand (baked-sand) cores.
2. Minimize depth to obtain flatter castings.
3. Use minimum weight consistent with sufficient thickness to cast without chilling.
4. Choose simple forms.
5. Symmetrical forms produce uniform shrinkage.
6. Liberal radii—no sharp corners.
7. If surfaces are to be accurate with relation to each other, they should be in the same part of the pattern, if possible.
8. Locate parting lines so that they will not affect looks and utility, and need not be ground smooth.
9. Specify multiple patterns instead of single ones.
10. Metal patterns are preferable to wood.
11. Permanent molds instead of metal patterns.

Moldings

1. Eliminate inserts from parts.
2. Design molds with smallest number of parts.
3. Use simple shapes.
4. Locate flash lines so that the flash does not need to be filed and polished.
5. Minimum weight.

Punchings

1. Punched parts instead of molded, cast, machined or fabricated parts.
2. "Nestable" punchings to economize on material.
3. Holes requiring accurate relation to each other to be made by the same die.
4. Design to use coil stock.
5. Punchings designed to have minimum sheared length and maximum die strength with fewest die moves.

Formed Parts

1. Drawn parts instead of spun, welded or forged parts.
2. Shallow draws if possible.
3. Liberal radii on corners.
4. Bent parts instead of drawn.
5. Parts formed of strip or wire instead of punched from sheet.

Fabricated Parts

1. Self-tapping screws instead of standard screws.
2. Drive pins or screws instead of standard screws.
3. Rivets instead of screws.
4. Hollow rivets instead of solid rivets.
5. Spot or projection welding instead of riveting.
6. Welding instead of brazing or soldering.
7. Use die-castings or molded parts instead of fabricated construction requiring several parts.

Machined Parts

1. Use rotary machining processes instead of shaping methods.
2. Use automatic or semi-automatic machining instead of hand-operated.
3. Reduce the number of shoulders.
4. Omit finishes where possible.
5. Use rough finish when satisfactory.
6. Dimension drawings from same point as used by factory in measuring and inspecting.
7. Use centerless grinding instead of between-center grinding.
8. Avoid tapers and formed contours.
9. Allow a radius or undercut at shoulders.

Screw-Machine Parts

1. Eliminate second operation.
2. Use cold-rolled stock
3. Design for header instead of screw machine
4. Use rolled threads instead of cut threads.

Welded Parts

1. Fabricated construction instead of castings or forgings.
2. Minimum sizes of welds.
3. Welds made in flat position rather than vertical or overhead.
4. Eliminate chamfering edges before welding.
5. Use "burn-outs" (torch-cut contours) instead of machined contours.
6. Lay out parts to cut to best advantage from standard rectangular plates and avoid scrap.
7. Use intermittent instead of continuous weld.
8. Design for circular or straight-line welding to use automatic machines.

Treatments and Finishes

1. Reduce baking time to minimum.
2. Use air drying instead of baking.
3. Use fewer or thinner coats.
4. Eliminate treatments and finishes entirely.

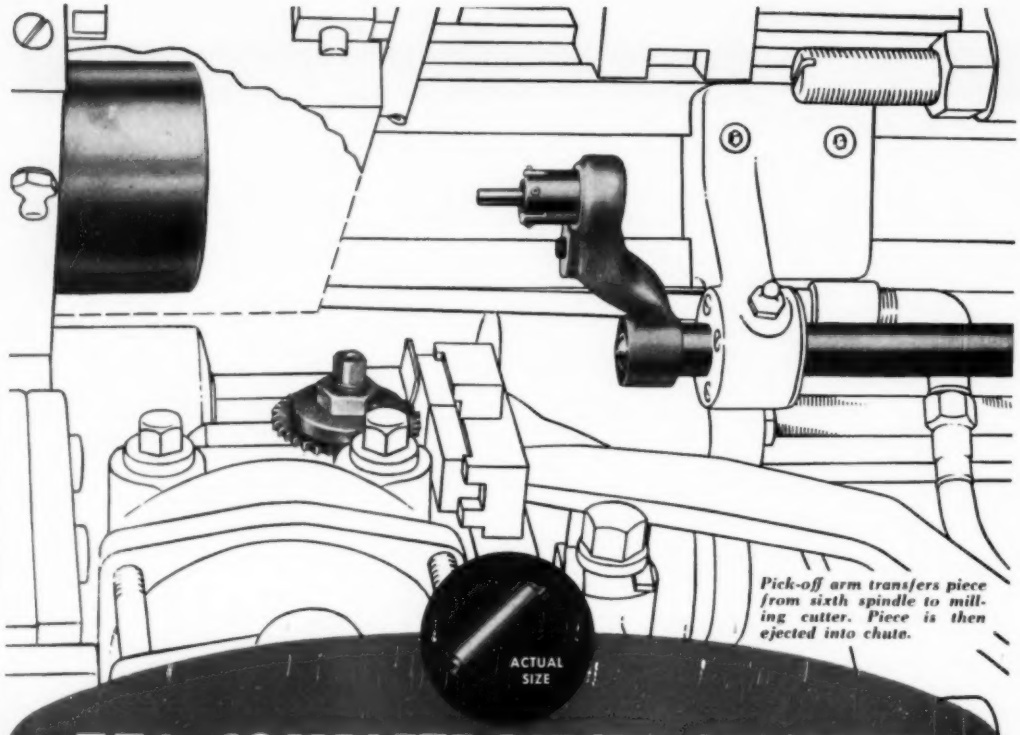
Assemblies

1. Make assemblies simple.
2. Make assemblies progressive.
3. Make only one assembly and eliminate trial assemblies.
4. Make component parts RIGHT in the first place so that fitting and adjusting will not be required in assembly.

This means that drawings must be correct, with proper tolerances, and that parts be made according to drawing.

General

1. Reduce number of parts.
2. Reduce number of operations.
3. Reduce length of travel in manufacturing.
4. Rely for accuracy upon "key" operations rather than upon series of closely held limits.



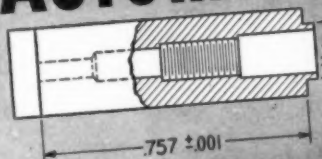
Pick-off arm transfers piece from sixth spindle to milling cutter. Piece is then ejected into chute.

ACTUAL SIZE

770 COMPLETE PIECES AN HOUR

Formed, drilled, tapped and milled on a Model 60

New Britain Automatic



Would you like to see other types of work done on this and other New Britains? Send for *"It Can Be Done"* . . . a fact packed portfolio of actual cost histories and money-making production methods.

Pick-off and transfer to milling attachment in sixth position makes it possible to drop off this complete piece in one operation, thereby holding down the cost of a highly competitive assembly. Because of the quantity involved, the close tolerances and the size of the piece, a second operation is out of the question.

Special machine performance on a general purpose machine with rigidity and accessibility means double protection of your machine tool investment.

NB

NEW BRITAIN

Automatics

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN-GRIDLEY MACHINE DIVISION
NEW BRITAIN, CONNECTICUT

449HD1

TALKING SHOP

Finders, Keepers

A GENERAL SUPERINTENDENT we know came back from the 1947 Machine Tool Show and was invited to report to the company executive committee.

"Was there anything there we should have?" asked the president.

"A quarter-million dollars' worth," said the general supt.

"What are you going to do about it?"

"Already did it—I bought 'em."

"What!" yelled the treasurer. "How are you going to pay for 'em?"

"I'm not; *you* are," said the g. s. "My job is to save money; yours is to find it."

"That's right," said the president, "Go ahead and find it!"

Let it be said to the credit of all concerned that the treasurer has found a little over $2 million in the last three years for the same purpose—but recently it has been much easier because saved production costs are showing.

Spurs Control Hp

REMEMBER the spur center on a wood-turning lathe? Jones & Lamson has gone back to it in tooling a 16-in. Fay automatic for an automotive driving pinion, and as a result can finish all exterior surfaces in one setting—except the face where the spurs are impaled. Twelve toolbits cut at once, to finish the piece in 8.5 sec. Seven tons hydraulic pressure on the dead center impales the forged blank (8620) on the spurs. This is eased to 1200 lb. as the cut starts, so the dead center will not spread the outer end when the end is turned down. Surface speed (max.): 1185 fpm. And those stubby spurs transmit 66 hp!

Sudden Repair

TEXAS ENGRG. & MFG. CO., INC., at Dallas, did about half the overhauls on C-54's for the Berlin Airlift. One major problem in reconditioning was to provide replacement parts without advance notice, because nobody can tell what replacements will be needed until teardown begins. Temco did it with a large and flexible tooling department.

Here's how the setup worked: Assume a plane which was found to have a cracked and corroded stabilizer rib. The old rib was sent at once to tooling, where it became the mockup for a plaster pattern. From the pattern the foundry made a kirksite die, which tooling cleaned up and sent to the hydropress section. The new part was ready in less than two days.

Farewell Expediters

ONE AUTO MAKER has cut his materials-handling organization—outside the plant. Now that the materials and parts shortage is over, it is cheaper to carry stock than pay salaries, travel and hotel expenses of expediters. The procurement forces have been cut 75% as a result.

Faster Engine

REO has a new 140-go engine for tractors that will handle trailers at almost passenger-car speeds, even in hilly country. This means faster transit and greater safety for other road users. . . . Engine production methods and some design features apparently stem from proximity to the new Olds engine plant. Transfer machines are used in many operations, but production rate of 20 per hr does not require many automatic-feed units. Engine assembly is done in an air-conditioned room with washed air.

Redistribution

ONE LARGE AUTO BUILDER has rented a large warehouse with four railway sidings inside and capacity for 25 to 30 freight cars. This warehouse supplies all main distribution-point warehouses in carload lots. All outside vendor-service equipment passes through this "redistribution center" and is allocated to the proper district without delay. Quicker turnover of service parts and reduced handling are claimed; there's no passing through routine factory receiving, inspection, stores, removal and reshipping. Savings in the first year are $1 million.

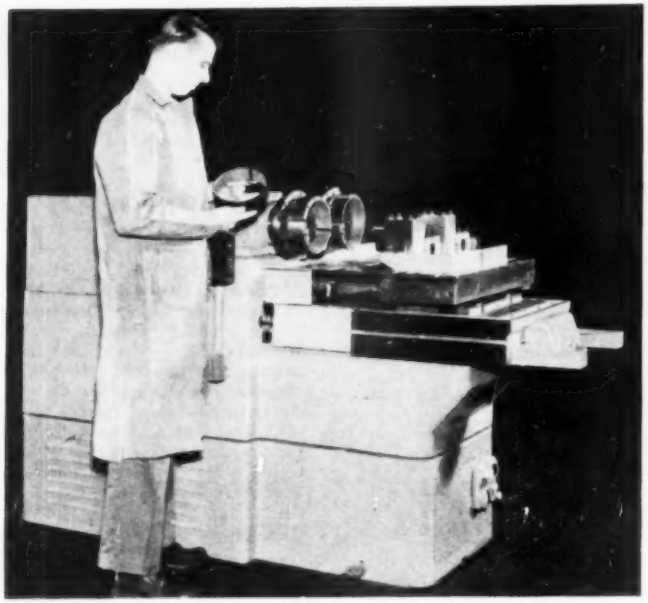
Next Job: Drawings

PLANT MANAGER (of the new school) called in his tool engineer (of the old school) and said, "We've got to get into production on this new product in a hurry. Let me have tooling drawings by the end of the month." At month's end, no drawings had arrived, so the manager sent for the offender. The tool engineer came in, greasy to the elbows, and said, apologetically: "Dammit, Boss, I haven't had time to get those drawings made yet; but I've just tested the tools. They work swell!"

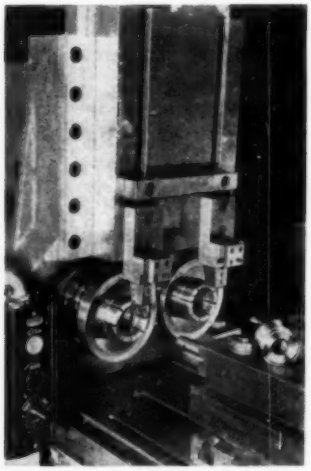
Chip Hogs

ONE FACET of the reviving interest in apprentices and trainees is disturbing. The old-time apprentice was taught to respect his machine and take care of it—usually did some cleaning and refurbishing on his own. But old-timers are now telling us in increasing numbers that the postwar trainees are frequently just chip hogs. In spite of instruction to the contrary, they toss files and wrenches onto ways, bang around precision instruments, let T-slots jam with chips, and do a sloppy, disinterested job in general. Some of the criticism is undoubtedly envy—but some is real enough. Precision and production both depend on good tools—and the man who can't appreciate good tools will never be worth his salt.

New Shop Equipment



1 *With positive cam actuation, single-point tool produces subsequent movements so that only one dimension need be checked*



2 *Machines can be equipped with vertical cross-slide for facing or other cross-working operations, and can be operated simultaneously with boring tool which is said to cut down the time of a job by as much as 50%. Size of job for machines is limited only by basic size of table as spindles may be raised or lowered, taking care of large or small pieces. Illustration shows pieces removed from chuck*

Precision Boring Machine Actuated By Cams

This precision boring machine is cam actuated, eliminating fluctuation regardless of internal or external temperature variations. The machine produces straight boring or turning, contour boring or turning, and facing with a cam-actuated single-point tool. The machine is said to hold closer tolerances because there is less tool strain and torque on work. Air-operated rapid traverse holds work within a few thousandths. Machine was designed for precision finishing operations on a wide range of work.

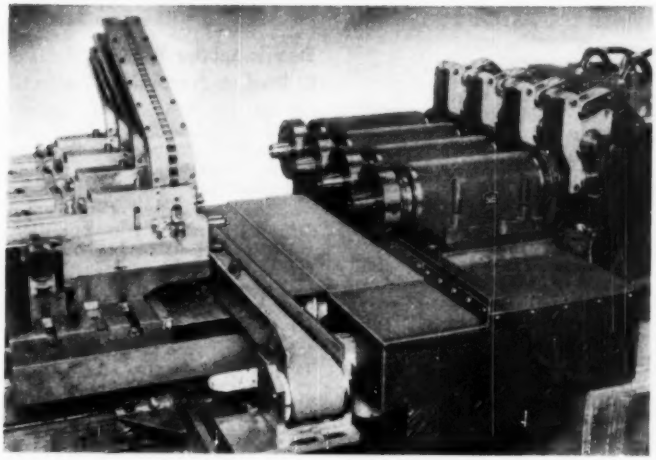
The line consists of two sizes of two different models: one type is straight boring and turning machine and the other has the contour table. Models 26 and 27 are the small and large size of the straight boring and turning machine. Models 36 and 37 are the small and large size of the contour turning and boring machine. The machine will finish small pieces limited only by the minimum practical diameter of the boring bar. On large work only limitation is size of tables. Spindles may be separated and raised above the bed of the machine to obtain necessary swing. Compound motion of the two tables of the contour machine produces the desired tool path. Both the longitudinal and contour tables of these machines are actuated by cams that close by air cylinders.

Machine will continuously hold size to 0.0001 in. and has a top spindle speed of 7500 rpm. Roughing operations are possible provided there is not too much stock to be removed. In setting up the machine for a job, work may be gripped and rotated in spindle and tools mounted on the tables, or the boring bar may be rotated in the spindle and the work held in a fixture on the table. The cam follower on the contour machine is of the V-type rather than a cam roll. The air cylinder which backs up the operation of the longitudinal table is also utilized to jump table into position and approach the tool to within a few thousandths of the work. This close approach is possible because the cam provides a positive stop for the air-operated rapid traverse, cutting idle time to a minimum.

Only one dimension of the finished piece need be inspected as cam actuated tool produces all the other dimensions. Toolholders are built with micrometer adjustment. To eliminate drag-off marks, tool jumps to bottom of bore, feeds into work and cuts on the draw-back stroke. This also prevents jamming chips in deep holes.

To produce a finer finish, tool may cut on both in and out strokes. Spindles can be arranged to change speed during cycle. Distance from top of longitudinal table to center of spindle on the Model 26 and 36 is $6\frac{3}{8}$ in., min. and on the Model 27

Materials and Parts



3 *One or more spindles can be mounted on machine. Spindles may be raised, lowered, separated, or brought close together*

and 37 is 9 in., min. Maximum table travel on the Model 26 and 36 is 7¾ and 4¾ in., respectively; on the Model 27 and 37, 15¾ and 11¾ in., respectively.

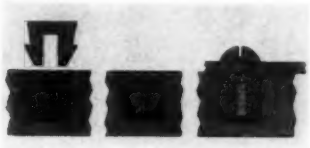
Heart of accuracy of machine is determined by spindles, which are manufactured to a maximum run-out of 0.000025 total indicator reading. Spindles are packed with a special grease for life of bearings.

On some jobs, where an extremely fine finish is required, the boring tool makes a double pass at the work, once on the feed in stroke and a second on the return stroke.

Cams are laid out and ground to close tolerances and mounted on one shaft. The V-type cam follower which is not as hard as the cam takes all the wear.

The two-speed spindle drive permits operating one portion of job at one spindle speed and another for the other portion.

New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Conn.



Brush Screw-Locking Inserts Provide Ready-Tapped Holes

These screw-locking inserts require no special tools, and provide ready-tapped holes for plastics and materials too thin to tap.

Inserts for plastics and other nonmetallic materials are available. A tapped hole which locks the screw against loosening from vibration is provided by pushing inserts into drilled holes. As the insertion of the screw expands these inserts, sharp corners cut into the work and form keyways against which they cannot turn and the locking drag on the screw is determined by the diameter of the hole drilled into the work. Ready-made tapped holes are furnished in 17ST aluminum for all sizes of screws. They can be furnished made of any metal. Screw-locking inserts are furnished in brass 3/16 in. long for use in all thicknesses of materials from 3/16 in. up.

Brush Nail Expansion Bolt Co.—Greenwich, Conn.

...INCLUDING

Milling Attachment has 1½-hp motor for all-angle high-speed carbide cutting.....page 126

Roll feeds have automatic starting and roll-release mechanism .....page 127

Four-spindle machine handles external forming, grooving, beveling, chamfering, cutting off of bar stock.....page 130

Tilting sheet-feeding attachment has eight angular adjustments to 45°.....page 132

Air-driven belt sander handles concave, convex metal or wood surfaces.....page 136

16-gage capacity metal shear has self-contained direct-drive unit .....page 140

Automatic-reverse tapping unit takes hand- or machine-screw taps from ⅜ to ⅞ in., pipe taps from ¼ to ½ in., in steel....page 142

NEW BULLETINS for Your Shop Library includes two catalogs, 66 and 76 pages respectively, dealing with all phases of carbide tools .....after page 154

...and in August 11

Contour grinding wheels are dressed within 0.0005 in or less. Unit can be mounted on any horizontal surface grinder.

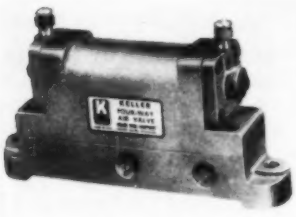
Electronic contour-following system guides machine tool to cut out metal parts according to drawing.

Economical process for brazing aluminum to steel offers good strength, broad adaptability.

Fray Milling Attachment Offers All-Angle Flexibility

This improved type 4 milling attachment is precision built for intricate jobs and has a 1½-hp motor for precision high-speed carbide cutting and all-angle flexibility permitting work at different angles without changing setup. Unit is equipped with precision No. 5 bearings having 30 milling machine taper. A positive direct drive and planetary back gear giving 3:1 reduction is provided through an involute 14-tooth spline drive. Kinking of spindle between bearings is eliminated by the short drawbolt, permitting close tolerances. Adapters are provided for attachment on various types of milling machines, planers, lathes, etc.

Fray Machine Tool Company, Glendale, Calif.

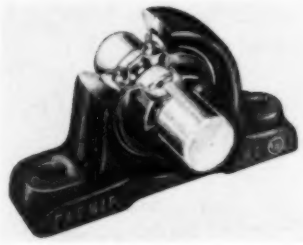


Keller 4-Way Air Valves Are Balanced-Piston Type

A new line of four-way air valves is of the balanced-piston type. Valves control double-acting air cylinders in the Keller Airfeedrills and are for use with other air tools or fixtures requiring fast, accurate control. Valve is actuated by poppet-type control buttons which exhaust the air from either end of balanced piston.

Piston is used for operating a faced slide valve, which is the actual seal for directional control of air flow. Valves are available in ¼-, ½- and 1-in. pipe threads, with air capacities of 30, 90 and 350 cfm, respectively. They can be bench mounted or mounted as an integral part of a fixture with remote control of operation. A stainless-steel piston for moving the slide valve is employed.

Keller Tool Co., Grand Haven, Mich.

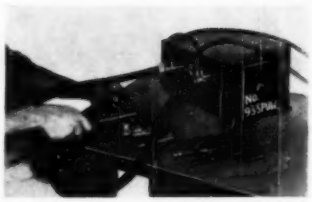


Fafnir Pillow Blocks Produced in Nine Shaft Sizes

This series of pillow blocks equipped with Fafnir Mechani-Seal ball bearings is designed as the LAO series. It is produced in nine shaft sizes ranging from 13/16 to 2-15/16 in. Each LAO incorporates a heavy-series ball bearing with wide inner ring and exclusive self-locking collar. Mechani-Seal is a labyrinth-type closure plus an external slinger member to throw off contaminants when operating at normal speed. For added protection at low speeds or under adverse atmospheric conditions, a combination synthetic rubber and felt washer is employed.

The Fafnir Bearing Company, New Britain, Conn.

GAS-POWERED Clipper has a 2000-lb capacity. Fork-lift truck has a load center at 24 in. from heel of forks. Wheelbase is 36 in. and frame has been widened for greater protection for wheels and to give more space for servicing. Improvements include a 30% higher brake horsepower and increased torque—*Clark Equipment Co., Industrial Truck Div., Battle Creek, Mich.*

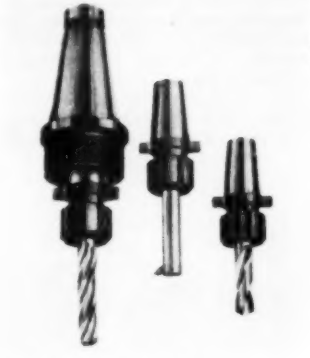


Electric Sputter Welder Utilized as Preparatory Tool

This improved electric sputter welder is designed for light metals especially thin hollow articles made from nickel silver, low-carbon and stainless steel, brass, etc. Welding machine is used as a preparatory tool for a following soldering operation. It eliminates hand binding and holding thin counterparts together by means of wires or clamps, to form the hollow body to be filled.

Sputter welder has a transformer for reducing shop current to current suitable for electric arc welding. There are five secondary taps on the transformer, each subsequent tap representing a higher secondary voltage. Use of taps is determined by thickness and type of metal to be joined. Parts to be welded are united by gentle brushing of work in a kind of tacking operation. A rheostat is supplied where heat adjustment is required. Welder is built in eight capacities from ½ to 3 kva.

Eisler Engineering Co., Inc., Newark, New Jersey

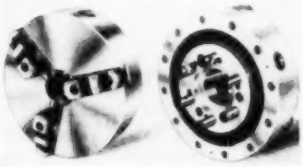


Kwik Switch Toolholder Offered for Multiple Operations

Kwik Switch toolholder permits rapid change of tools on jobs requiring multiple operations such as drilling, tapping, boring, etc. Changes are said to be possible in less than 10 sec. without loss of close-tolerance accuracy. Master chuck fits into machine, and adapter chucks which

hold tools fit into master chuck. Toolholders handle tools with either straight or taper shanks. Master chuck is available in straight and taper shanks to fit standard machine tools.

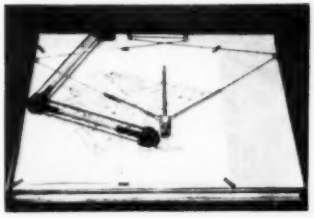
Universal Engineering Co., Frankenmuth, Mich.



Heat-Treated Aluminum-Alloy Comes in Sizes to 15 in.

The Whitaloy chuck is forged of a special-analysis heat-treated aluminum alloy considerably reducing weight. This feature permits quicker start and stop and eliminates spindle drag. Decreased weight on spindle reduces stress and strain on the braking mechanism. Jaws, scroll and pinions are made of heat-treated alloy steels. The Whitaloy is adaptable to all spindle noses and is available in all sizes and types up to 15 in.

The Whiton Machine Company, New London, Conn.



Instrument for Perspective Drawings Guides Pencil

This draftsman's instrument for perspective drawings is called the Perspect-O-Metric. It automatically guides the draftsman's pencil toward the established vanishing point from any position upon the drawing board. Special scales reduce distant portions of subject to their correct proportions. Instrument attaches to any standard drafting machine, and to parallel-ruling straight edges.

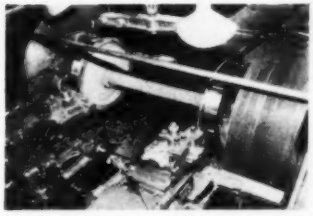
Perspect-O-Metric has three scale arms. The central arm is fixed in a position at right angles to the established base line. Left and right scale arms pivot at one end and swing in plane of the drawing board.

Charles Bruning Co., Inc., 4754 Montrose Ave. Chicago 41, Ill.

Improved Carbide-Tipped Tools Are Stress Relieved

Line of stress-relieved carbide-tipped tools of the Nelco slash-milled design eliminates brazing strains. Larger sizes also slash milled are brazed with nickel or constantan shim between brazed surfaces. Tip is brazed to one surface rather than three. This minimizes brazing strains eliminating grinding cracks and tool breakage. All Nelco carbide tips overhang the steel shank allowing several regrinds before the steel must be ground. Tools are offered in all standard grades of carbide and are available either milled and brazed or finish ground.

The Nelco Tool Company, Inc., Manchester, Conn.



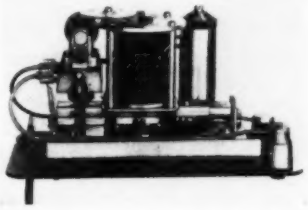
PROFILING ATTACHMENT for car-wheel lathe produces to 22 sets of wheels per day. Lathe with tread profiling attachment is a hydraulic device producing profile on wheel tread that is exact duplicate of templet. It permits use of carbon tools on turning steel car and loco wheels at cutting speeds of 150 to 195 fpm, with ¼- to ½-ipm speed. Profiling method gives concentricities of 0.002 to 0.004, equal to those obtained through grinding— ***Built for Baltimore & Ohio Railroad Co. by Nile Tool Works of Lima-Hamilton Corp., Hamilton, Ohio***

Roll Feeds Have Automatic Starting, Roll-Release Mechanism

This roll feed is equipped with automatic starting and roll-release mechanism. Operator raises upper roll of the feed into a locked position using handle. With upper roll in the open position the stock can be moved through the roll feed and into the die. The stock is located by sight or by a stop.

When operator trips the press and ram descends, the roll feed will not feed material inasmuch as upper roll is open. As the ram continues its downward motion, and punches enter the stock, trip extension located on ram of press hits the release cross bar on the feed, releasing upper roll and returning it to feeding position. As ram ascends and punches are clear of stock the roll feed engages instead of in the conventional manner halfway-up and halfway-down.

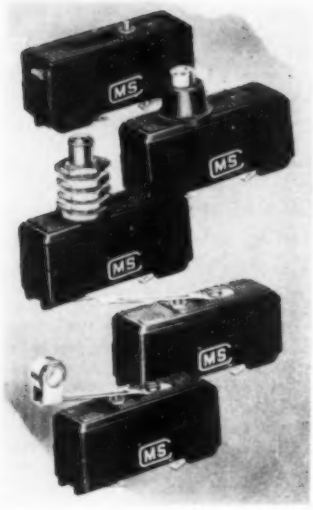
U. S. Tool Co., Inc., Ampere (East Orange), N. J.



Temperature Transmitter Detects Process-Temperature Variations

The force-balance type pneumatic temperature transmitter is called the Taylor Transaire. Instrument is designed for applications where it is desirable to have the indication, record or control remotely located from the point of measurement and where it is necessary to have accuracy, high speed of response, small thermal elements and short-range spans within the limits of —375 and +1000 F. Speed-Act feature applies principles of pre-act or derivative action directly to temperature determination. It overcomes lag inherently present in the response of any form of thermal measuring element.

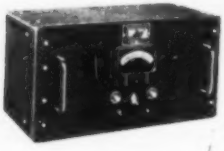
Taylor Instrument Companies, Rochester 1, N. Y.



High-Capacity Precision Switches Have Five Actuator Designs

High-capacity precision switches, type A, are for a steady state current rating of 20-amp, 125-, 250-, or 460-v ac; motor-load rating of ¾ hp, 115-v, 1½-hp, 230-v ac; and a lamp load rating of 10-amp, 125-v ac. Inrush capacity is 75 amp at voltages to 460-ac. Actuators are permanently attached to cover of plastic case. Five designs are available with double-throw contact arrangement for normally open or normally closed switches. A choice of four terminals includes solder terminals, screw-type bottom-faced terminals, screw-type side-faced terminals, or the new Micro Latch separable terminals.

Micro Switch, Freeport, Ill.



Automatic Voltage Regulator Rated at 2-kva Output

This small automatic voltage regulator rated at 2-kva output is listed as the Stabiline type EM 4102. Regulator is electromechanical in operation and consists of a Super Electric Powerstat variable transformer controlled by a specially designed electronic detector. Regulator is offered as a cabinet-contained or rack-mounting unit. Input voltage range is 95 to 135 v. Output range is adjustable between 110 and 120 v.

The Superior Electric Co., 79 Hannon Ave., Bristol, Conn.

Analyzer Checks Range, Adjustment Of Powered Torque Tools

Livermont analyzer is a testing device for checking the tightening capacity, range, and adjustment of powered torque tools. Tool predetermines a standard and maintains it on the line. Analyzer will read the high rpm kinetic-energy tools which deliver their ultimate with the first cycle and a lesser amount of torque on subsequent cycles unless tool is permitted time enough to return to full maximum rpm. It is portable and measures 3 ft. 6 in. by 2 ft. 2 in. by 1 ft. 8 in. Analyzer will demonstrate on direct drives, for example, the torque at which the clutch releases and at what rate torque increase is accomplished beyond the releasing point if held into engagement.

Richmont, Inc., 2810 E. 11th St., Los Angeles 23, Calif.

Stanley Electric Drill for Production Work Is Lightweight

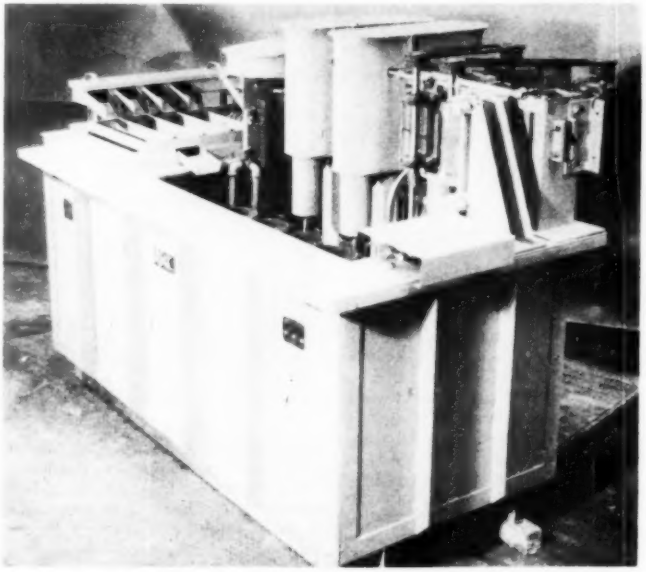
This No. 24A ¼-in. electric drill can be used at full load for continuous drilling without stalling. Speed is 1800 rpm for no load; 1100 rpm for full load. Construction features aluminum-alloy die-cast housing and oil-impregnated bronze bearings.

Stanley Electric Tools, New Britain, Conn.

Square D Circuit Breaker Has 50-amp, 600-v Capacity

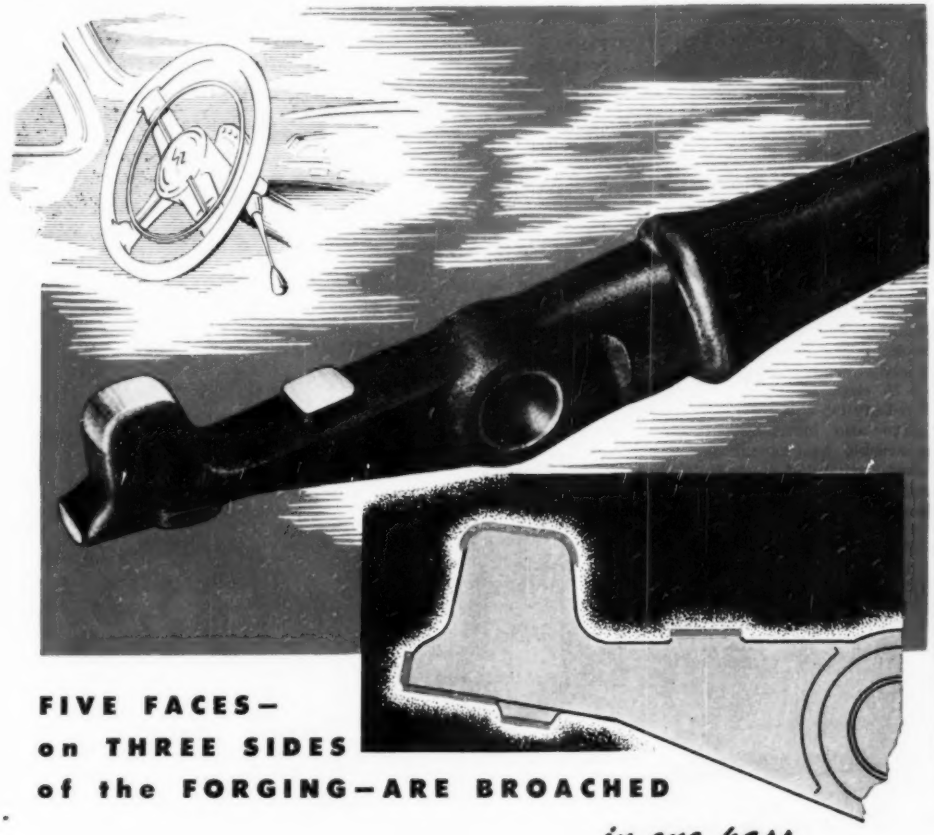
This compact 50-amp, 600-v and 100-amp 250-v circuit breaker includes all construction features of the smaller ML and larger ML-2, ML-3 and WL breakers but is 50% smaller than the previous unit for this capacity. Unit is available as either a circuit breaker or a circuit interrupter of high interrupting capacity. Square D's thermal-magnetic (coilless) tripping mechanism is included. A thermal element holds harmless momentary overloads, but trips before wire insulation overheats on continuous overloads.

Square D Company, 6060 Rivard Street, Detroit 11, Mich.



ISOTHERMAL QUENCH FURNACE provides rapid and uniform cooling of work and a method of extracting the high-temperature chloride salts carried over from the austenitizing bath. Furnace provides a vigorous upward flow of molten salt in headers into which hot work is introduced. Salt is circulated by submerged pumps. For removal of chloride contamination a separate steel tank is built into one end of the unit—*Ajax Electric Co., Inc., Frankford Ave., Philadelphia 23, Pa.*

500 FORGINGS *Broached* PER HOUR



FIVE FACES—
on THREE SIDES
of the FORGING—ARE BROACHED

in one pass

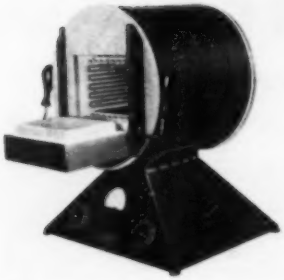
Cleveland Hardware & Forging Co. broaches five faces on this gear shift lever forging in one pass with an hourly production of 500 pieces. To finish these same faces by previous methods took three operations. In addition, all surfaces are now suitable for final assembly as they come off the broaching machine. The tooling which allows the broaching of two pieces per pass was designed and built by Detroit Broach Co. for a hydraulic press.

This is typical of the savings to be had by applying broaching to your parts production. Whether an intricate contour or a simple notch to be produced, broaching offers greater production, less idle machine time, fine finishes and identical form and dimensions on each part produced.

Detroit Broach application engineers specialize in broaches and broach tooling exclusively. They are familiar with all types of broaching and all broaching machines. This specialized experience is at your disposal to help solve your broaching problem. Write today for our representative to come in for a discussion.

DETROIT *Broach* COMPANY

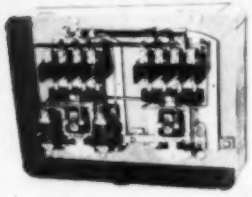
20201 SHERWOOD AVENUE
DETROIT 12, MICHIGAN



Hevi-Duty Muffle Furnaces Housed in Cylindrical Shell

Muffle furnaces designed primarily for general-laboratory requirements such as drying of precipitates are housed in cylindrical shells mounted on pyramidal-type bases. Design permits free circulation of air and eliminates trapped heat in base. Instruments and controls are approximately at room temperature. There are 36 steps of control through a Hevi-Duty tap-changing transformer. Design also incorporates multiple replaceable heating units, and recessed position of controls for protection. Instruments are accessible through removable panels.

Hevi-Duty Electric Co., Milwaukee 1, Wis.

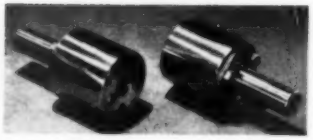


AC Magnetic Reversing Starters Are Across-the-Line Type

This line of ac magnetic reversing starters is designed for industrial control applications. Starters with three poles are available for across-the line starting and reversing of polyphase motors to 200 hp, 550 v, 60 cycles, inclusive.

The four-pole starters with ratings of 7½ hp, 550 v, 60 cycles maximum, are utilized with externally reversible single-phase motors of the four-wire split-phase, capacitor- or repulsion-induction type. Starters have two magnetic contactors inter-wired for reversing operation, mechanically interlocked with or without thermal overload protection.

Ward Leonard Electric Co., Mount Vernon, N. Y.

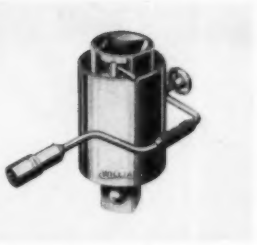


Releasing-Type Tap Holder Operates Within 0.005 in.

This tap holder said to eliminate breakage operates to within 0.005 in. The releasing-type holder permits only the working part of tap to be exposed. Shank that fits into the turret is separate from the body of the holder. Two parts are held together by three screws. Holes allow about 3/32-in. movement to align the tap with hole.

Sensitive pawl is calibrated so that when motor is reversed ratchet cannot ride more than a quarter turn before catching and slips into place automatically. By changing direction of pawl, holder may be changed for right- or left-hand tap.

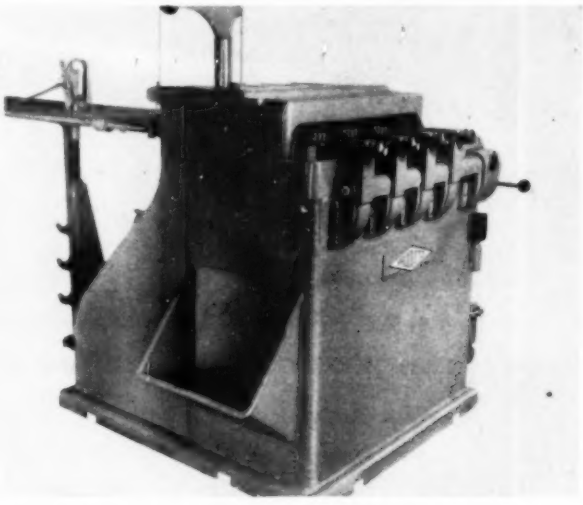
Marcellus Mfg. Co., Belvidere, Ill.



Ratchet Adapter Works with Any ½-in. sq Drive Handle

Ratchet action is possible in limited quarters with the Williams ratchet adapter. Its use with any of the ½-in. square drive handles or attachments such as speeders, T-handles, etc., increases versatility of the driver by converting it to a ratchet tool. Adapter finished in chrome-plate is 2-9/16 in. long and has a 1¼-in. dia. Ratchet gear has 30 teeth; shift lever reverses action.

J. H. Williams & Co., 400 Vulcan St., Buffalo 7, N. Y.



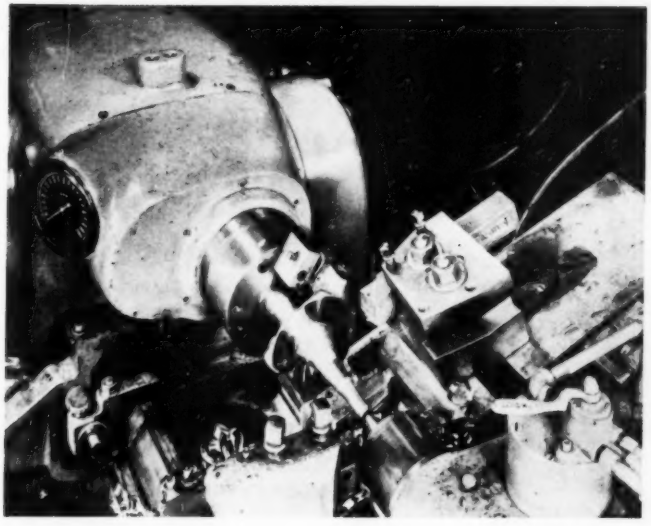
Bar-Matic Four-Spindle Machine For External Forming, Grooving

This four-spindle Bar-Matic machine handles high-speed production of external forming, grooving, beveling, chamfering and cutting-off of bar stock. Bar-feed arrangement features low air pressure for rapid feeding of 12-ft. bars simultaneously to four adjustable stops. Four sets of forming and cut-off tools are mounted on a horizontal slide which is cam-operated longitudinally, assuring accuracy regardless of the temperature.

Spindle speeds are variable and range from 900 to 2000 rpm. Cycle changes are obtained by handwheel control without stopping machine. Parts can be formed and cut off at a rate of 1400 to 2400 per hr. Capacity is $\frac{5}{8}$-in. dia max, with cutoff lengths to $6\frac{5}{8}$ in.

The Producto Machine Company, Bridgeport, Conn.

SAVE WITH SINGLE-POINT TOOLING



Air-gage trace it on the MONARCH MONA-MATIC

You can turn it faster, cheaper, more accurately—on an Air-Gage Tracer-equipped Mona-Matic.

Here's a typical example: forged steering knuckles finish machined in 1.23 minutes—*in one setup*. Performance like this is characteristic of Air-Gage Tracing—the exclusive Monarch method that provides single-point, automatic cycle metal turning for multiple diameter parts.

Expensive forming tools and complicated multiple tool setups are completely eliminated. There's practically no work distortion; the accuracy of this method often reduces *by half* the amount of grinding stock. You'll save on setup time, too—it almost never exceeds fifteen to twenty minutes. What's more, one man can operate two machines—*easily*.

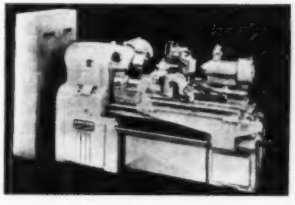
On the steering knuckle job illustrated, full advantage is taken of two optional *plus* features: the two-speed main drive motor permits shifting to half speed at any desired point in the cycle—to maintain finish as the tool moves out along the flange. The rear tool slide is timed to lead the front tool slide, performing a roughing cut on the flange to prolong the life of the front tool.

The second plus feature is the automatic feed change—providing up to five infinitely variable feeds, as required. This flexibility of operation allows maximum machining efficiency in the removal of variable stock, so characteristic of forgings.

The Mona-Matic method is adaptable to a vast variety of workpieces; it has made spectacular savings on many a production line. May we show you how it can help lower your own costs?

JOB FACTS

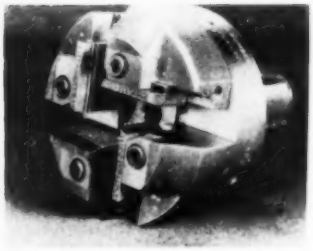
Part—Steering Knuckle
Material—SAE 3135 forging
Operations Performed—Turn stem complete; face flange
Cutting Tool—Carbide Insert
Tolerance—± .001"
Total Machining Time—1.23 minutes
Note—Two pieces are produced in the above time, as one man operates two machines.



THE MONARCH MACHINE TOOL COMPANY • Sidney, Ohio

ACCURACY · ECONOMY · LONG LIFE
Monarch TURNING MACHINES

FOR A GOOD TURN *FASTER*—TURN TO MONARCH



Solid Adjustable Die Heads For Threading Cast-Iron Fittings

This die head is designed for use on automatic machines for threading street ells and similar cast-iron fittings where clearances are limited between die head and machine. Diameter of die head is $3\frac{3}{4}$ in., and to provide further clearance chaser holders are beveled off on a 45° angle.

The $\frac{1}{2}$- and $\frac{3}{4}$-in. solid adjustable die heads use chasers $15/16 \times 1\frac{1}{4}$ in. Individual adjustment is provided for each chaser holder.

Landis Machine Company, Waynesboro, Pa.

Center-Cut Bolt Cutters Have Capacities to 7/16-in. Solid Rod

Special center-cut bolt cutter has chisel-type jaws. Jaws are of forged tool steel specially heat treated and permitting cutting of case hardened bolts, chain, reinforcing rod and other hard materials. Through compound leverage, the tool affords 2-ton cutting power at jaws with 50-lb pressure at the handles. Cutter is available in 18-, 24-, 30- and 36-in. sizes with capacities up to 7/16-in. solid rod. Head assembly will fit standard bolt cutters.

Manco Manufacturing Company, Bradley, Ill.

Supervisory Annunciator Gives Visual, Audible Alarm

This supervisory annunciator gives visual and audible alarms when trouble develops. It can be used in connection with overheated bearings, low fuel level, too low or too high pressures, too high cooling temperatures, etc.

When trouble occurs annunciator receives an electrical impulse from a normally open or normally closed, momentary contactor such as a thermostat or float switch. This impulse causes a contact which operates a visible signal, indicating on the board where trouble is developing, and simultaneously sounds an audible alarm. Known as the Auth No. 1518 Bull's-Eye lamp-type supervisory annunciator it is designed for flush, surface or panel mounting, open- or closed- circuit operation on voltages from 24- to 250-v, ac or dc as specified. The audible signal is a 3-in. heavy-duty bell or horn.

Auth Electric Co., Inc., 34-20 Forty-Fifth St., Long Island City 1, N. Y.

Precision Test Blocks Available for All Rockwell Scales

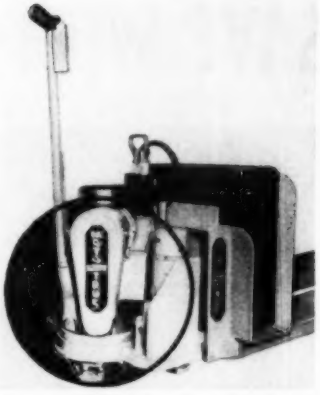
This series of precision test blocks has been held to close tolerances. While specifically manufactured for use with Clark Rockwell hardness testing machines, they give accurate results on any Rockwell-type hardness tester. Blocks are available in hardness grades for all Rockwell scales. Limits covered by each block are stamped on the edge.

Clark Instrument, Inc., 10200 Ford Road, Dearborn, Mich.

Electrode Makes Short Intermittent Welds at High Speed

This electrode, Hobart No. 313, makes short intermittent welds at high speed on all gages of steel in any position using ac or dc straight or reverse polarity. It is said to have fast operating characteristics, together with a forceful spray-type arc. Arc can be started and restarted without scraping or hitting electrode against work surface. Tendency for this type of electrode to stick to work has been eliminated. Electrode is available in 12-in. lengths in 3/32-in., and 14-in. lengths in $\frac{1}{8}$-, 5/32- and 3/16-in. sizes.

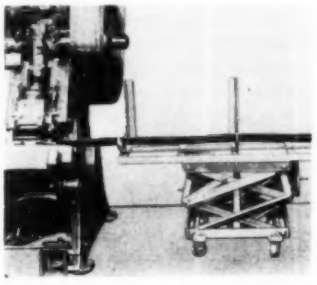
Hobart Brothers Co., Hobart Square, Troy, Ohio



Motor on Hand-Truck Equipment Has Roller-Type Control Handle

This motor for hand-truck equipment permits accessibility to operating parts. Larger armature and field coils, high starting torque and lower draw on battery are features. The interchangeable-motor feature of the Moto-Truc permits replacement of motors in 15 to 30 min, minimizing delays in servicing. Pushbuttons to the ends of the handle (within fingertip reach) control lifting and lowering of truck forks or platforms. Roller-type control handle gives two speeds forward and two speeds reverse by a turn of the wrist in direction of travel.

Moto-Truc Co., Cleveland, Ohio



Tilting Sheet-Feeding Attachment Has Eight Adjustments to 45°

This tilting sheet-feeding attachment is announced for company's elevating table. It is made of steel and has eight angular adjustments up to 45°. Width of rack is 20 in., maximum length of rack, 72 in.; capacity of rack, 1000 lb; weight, 100 lb; length of brackets, 8 in. List price is $125. It is shown with the Montgomery elevating table.

Montgomery & Co., Inc., 53 Park Place, New York 7, N. Y.

Another outstanding J&L development—

"E"

J&L FREE-CUTTING STEEL

J&L STEEL

A New Bessemer Screw Stock with Proved Machinability Ratings as High as 170!

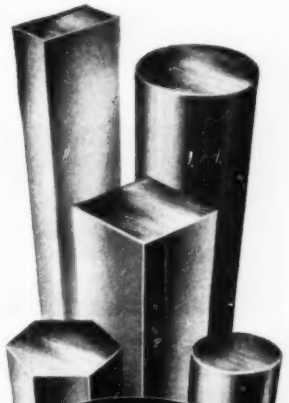
- **Backed by 50 years of leadership in the field of free-machining, cold-finished steels.**
- **Proved by exhaustive field testing.**

Forty-five independent machine shops, throughout the metal-working industry, have tested over *6,100 tons* of J&L "E" Steel in more than 100 applications. These shops report:

- **Better Machine Finish**
- **Longer Tool Life**
- **Higher Speeds**
- **Machinability Ratings up to 170**
- **Better Response to Forming and Cold Work**
- **Higher Magnetic Permeability**

For 50 years J&L has led in the development of free-cutting, cold-finished steels—both bessemer and open-hearth. Every new J&L steel introduced in this field has been a major contribution toward the lowering of the unit cost of machined steel parts. *Now we offer you J&L "E", a bessemer grade steel with distinctly greater free-cutting efficiency.*

You will want complete information on this latest J&L steel development. Let us discuss the money-saving possibilities of J&L "E" Steel with you. The coupon is for your convenience.



All standard sizes and shapes are available.

J&L "E" Free-Cutting Steel is made in *three* grades: E-15, E-23 and E-33, each within the composition limits of the standard bessemer screw steels and with similar tensile properties. Note the following equivalents:

E-15—equivalent standard grade, B-1111
E-23—equivalent standard grade, B-1112
E-33—equivalent standard grade, B-1113

Jones & Laughlin Steel Corporation
402 Jones & Laughlin Building
Pittsburgh 19, Pa.

I should like to have more information on J&L "E" Free-Cutting Bessemer Screw Stock. Please have your representative call.

NAME _____

TITLE _____

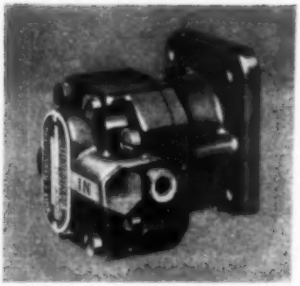
COMPANY _____

ADDRESS _____

JONES & LAUGHLIN STEEL CORPORATION

From its own raw materials, J&L manufactures a full line of carbon steel products, as well as certain products in OTISCOLOY *and* JALLOY *(hi-tensile steels).*

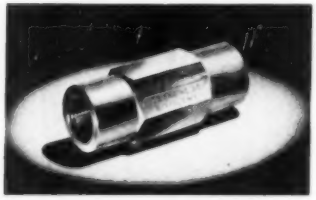
PRINCIPAL PRODUCTS: HOT ROLLED AND COLD FINISHED BARS AND SHAPES • STRUCTURAL SHAPES • HOT AND COLD ROLLED STRIP AND SHEETS • TUBULAR, WIRE AND TIN MILL PRODUCTS • "PRECISIONBILT" WIRE ROPE • COAL CHEMICALS



High-Pressure Pumps Maintain Continuous Pressures to 1000 psi

This line of high-pressure gear pumps maintains continuous pressures to 1000 psi and intermittent pressures to 1500 psi. Pumps have the same mounting dimensions as the standard low-pressure models, and are part of the Constant-Flo rotary gear-pump line. They are particularly designed for power units and materials-handling equipment.

John S. Barnes Corp., 106 Walnut St., Rockford, Ill.



Oil Automatic Shutoff Valve For Compressed Air, Liquid, Gas

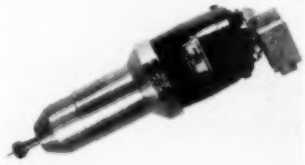
This automatic safety shutoff valve, for use on compressed air lines, fits standard connections and is inserted at the intake end of the air hose. When break occurs in hose, valve closes and shuts off pressure, permitting only a light stream of air to escape through a bypass. When hose is repaired, pressure will equalize on both sides of the valve and a spring opens it automatically. This eliminates necessity of turning off valve before making repairs. Valve can also be used for gases, steam and light liquids flowing under pressure, as well as air.

Olin Engine Co., 9-11 Lafayette Ave., Buffalo 13, N. Y.

Felseal Coatings Available in Thicknesses of 0.001 to 0.005 in.

Improved Felseal coatings can be applied to any fibrous-type base material in film thicknesses of 0.001 to 0.005 in. Coating is not materially affected by mineral or vegetable oils, fats or soaps, aliphatic and aromatic hydrocarbons, lower alcohols, carbon tetrachloride, or dilute acids and bases. It operates efficiently under service temperature from —30 to 225 F, and is especially suited to such units as automatic transmission, differentials, carburetors, etc. Base materials, such as chipboard, treated paper and fiber are furnished in thicknesses of 0.010 to 0.125 in. Felseal permits the use of inexpensive base materials, even for severe oil, fuel and solvent applications. Castings and machined parts are sealed without using a finishing cut or surface grinding.

Felt Products Mfg. Co. 1508 Carroll Ave., Chicago 7, Ill.



Redesigned Automatic Drill Unit For Holes from No. 50 to ¼ in.

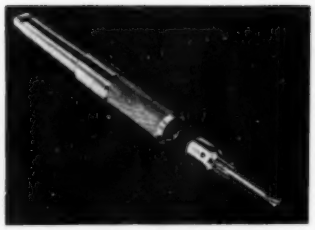
Redesigned automatic drilling unit includes a constant bath of oil for all moving parts. It is designed to drill holes ranging from No. 50 to ¼-in. dia in metals, plastics, etc. Self-contained, it can be mounted at any angle or plane and it is especially adapted for drilling of several holes in one operation when incorporated in a special machine.

Simplex Tool Engineering Co., 2540 Park Ave., Detroit, 1, Mich.

Vari-Pitch Sheave Substituted For Larger Threaded Plate Sheaves

Allis-Chalmers is discontinuing its adjustable threaded plate sheaves in the larger sizes, recommending Vari-Pitch sheaves to be substituted. Because users tend to overload large-size adjustable sheaves without properly anchoring and adjusting plates, uniform service has not been possible. When the horsepower of an adjustable-speed drive exceeds 2 or 3, depending upon application, a stationary-control Vari-Pitch sheave should be used. Adjustable sheaves up to and including 6.125 in. in outside circumference are still available from the company.

Allis-Chalmers, Milwaukee, Wis.



Dahlstrom Tap Chuck Eliminates Center-and-Wrench Method

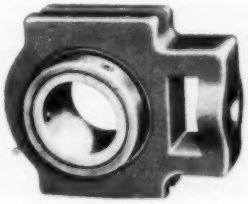
This Dahlstrom tap chuck is used for occasional power-tapping jobs. It eliminates the center-and-wrench method of tapping on a lathe or drillpress. Tap floats, increasing threading accuracy. Included are seven interchangeable tap adapters in sizes from 8/32 to ½ in. Chuck is made in Nos. 2, 3 or 4 Morse taper. Over-all length is 8⅝ in. Price is $21.50 including adapters.

Dahlstrom Mfg. Co., Dept. B 2520, Larpenteur Ave., W., St. Paul 8, Minn.

Work Positioner Utilized As Soldering Base, Angle Plate

The Positionette is a lightweight, self-contained work positioner. The table is adaptable to practically all sizes and shapes of fixtures. It is also used as a soldering base and angle plate. Made of heavy cast aluminum, it is 5½ in. high. Table measures 4x5¾ in. Positioner is priced at $4.95.

Solon Foundry, Inc., 1510 University Road, Cleveland 13, Ohio.



Ball-Bearing Take-up Unit Permits Changes in Shaft Position

This Wide Slot SC ball-bearing take-up unit consists of a deep-groove precision bearing with large balls and retainer enclosed in an outer housing with milled slots on each end for supporting guides. Housing has a hole for receiving unthreaded end of an adjusting screw. Bearing is suitable for conveyor and power-transmission service where provision must be made for changes in shaft position.

Dodge Manufacturing Corp., Mishawaka, Ind.

Forming a 6-inch diameter cylinder on a Steelweld Press. Machines can be furnished for forming cylinders in lengths up to 20 feet.

SMALL DIAMETER CYLINDERS QUICKLY PRODUCED

Small diameter cylinders, square and hexagon tubing and other closed shapes are easily made with simple dies on Steelweld Presses. Special steel dies are usually used for large quantities, but for small numbers a steel male die and a female pressure pad made of rubber is often used.

A series of successive bends are made starting at the ends of the sheet and finishing with the center bend. The dies are so made that the cylinder or tube when removed from the machine will spring to a closed position.

This is only one of the dozens of different jobs that can be done on any Steelweld Press.

GET THIS BOOK!

CATALOG No. 2010 gives construction and engineering details. Profusely illustrated.

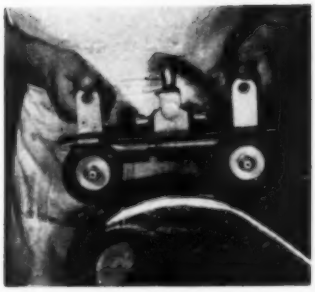
THE CLEVELAND CRANE & ENGINEERING CO.

1416 EAST 281st STREET • WICKLIFFE, OHIO

STEELWELD

BENDING PRESSES

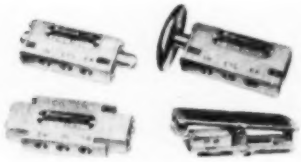
BRAKING • FORMING • BLANKING • DRAWING • CORRUGATING • PUNCHING



Air-Driven Belt Sander Works On Concave, Convex Surfaces

This air-driven belt sander handles all types of surfaces whether concave or convex. Sander is applicable to metal finishes, both sheet metal and solid castings and to iron, steel, brass, bronze, solder, aluminum and magnesium. It is also suitable for finishing and sanding wood products.

Buckeye Tools Corp., 21 West Apple St., Dayton 1, Ohio.



Compact CRV Series Control Valves For Pneumatic, Fluid Circuits

This CRV series pilot valve, when used in conjunction with CV series valves, constitutes an air limit switch. Designed for pneumatic or fluid operating circuits, the three- or four-way ⅛-in. port size CRV valve can be used for remote control of single- or double-acting air devices. Compact size permits gang mounting where drum cams are required. It is adaptable for hand, foot, cam or pressure actuation, permitting installation as part of a timed sequence. Construction eliminates metal-to metal-contact by use of O-ring seals. Valve is of balanced-piston type.

Modernair Corp., 4222 Hollis St., Oakland, Calif.

Westsorb Eliminates Vibration, Comes in Three Densities

Westsorb eliminates vibration on all types of machinery. It does away with floor bolts to anchor machines. Material is available in three densities and ½-, ¾-, and 1-in. thickness. Westsorb is made from uniformly blended wools.

Western Felt Works, Chicago, Ill.

Redesigned Centrifugal Switch Has Contact-Blade Stops

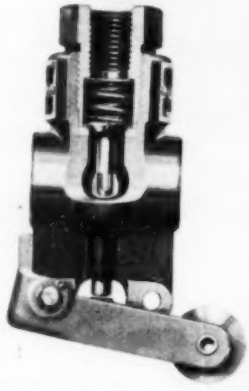
This centrifugal switch is for plugging, overspeed or underspeed protection, non-plugging and motion interlocking. A ball-bearing is mounted on the contact-making arm to minimize friction. Contact-blade stops lessen wear of contacts. Switch is available in dust-tight and oil-resistant inclosures for surfaces or flange mounting, with any standard contact arrangement, and has an operating range for the contacts to open or close from a minimum of 125 rpm to 2530 rpm.

Euclid Electric & Mfg. Company, Madison, Ohio.

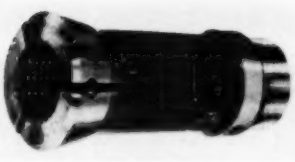
Lampless Infra-Red Units Bake, Dry, Preheat, Carbonize

Insulated Spir-O-Therm lampless units bake, dry, preheat, carbonize and dehydrate. Diagonal positioning eliminates hot spots and hot streaks existent in horizontal 90° lamp set-ups, and directs heat uniformly on product moving on a conveyor. Pyrex tubes have spiral channel resistors, stainless-steel contacts, and stainless-steel reflectors. There is little transmission loss due to channel construction of the resistance-alloy. No round wire, flat wire or ceramic packing is used.

The Miskella Infra-Red Co., East 73rd and Grand Ave., Cleveland 4, Ohio.



AIR VALVE permits removal of metal chips and other scrap material. The Air Saver valve can be mounted in any position to operate at any angle, unaffected by machine vibration. Ample air volume is possible for operation of multiple or single jets. Air-saver is used in cleaning, drying, cooling, positioning and ejecting—*Palmer - Shile Co., 16020 Fullerton Ave., Detroit 27, Mich.*



Cloverleaf Grind for Collets Provides Cam Relief at Slots

The new Cloverleaf grind on the external bearing surfaces of all collets provides a cam-relief at the slots enabling a positive bearing in the center of each jaw section. Grind is applied to all Sheffer collets for hex, and square, and round stock. Cam form provides for a tighter lock with less strain on the chucking mechanism and free release regardless of stock variations or worn conditions of either collet or spindle.

The Sheffer Collet Company, Traverse City, Mich.

Degree of Filtration Controlled Between 0.040 in. and 5 Microns

This lower-priced industrial filter for hydraulic and lubricating oils consists of a series of spacers and fine mesh screens or other filtering media. By varying mesh degree of filtration can be produced between 0.040 in. and 5 microns. Flow rate can be varied by adding or subtracting screens and spacers. With removal of one nut all spacers and screens come apart. No cartridges are used.

General Filters, Inc., 12890 Westwood, Detroit 23, Mich.

Super Tool Offers Seven Types of Carbide-Tipped Tools

Line of seven types of carbide-tipped tools for turning, boring, facing and threading in a wide range of sizes includes both left- and right-hand styles in side-cutting types. All tools are standard with optional grades of carbide for cutting steel or other materials. Other grades can be obtained.

Super Tool Co., 21650 Hoover Road, Detroit 13, Mich.

Wire Wheel Brush Has Steel Bristles Imbedded in Rubber

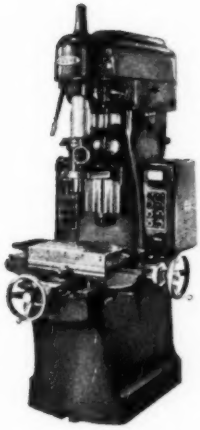
This wire wheel brush has steel bristles firmly imbedded in rubber. It is being produced in 6-, 8- and 10-in. industrial sizes. Brush can be used on either bench or portable tools.

Hewitt-Robins, Inc., 370 Lexington Ave., New York 17, N. Y.

"You can't do *today's* job with *yesterday's* tools and be in business *tomorrow*"

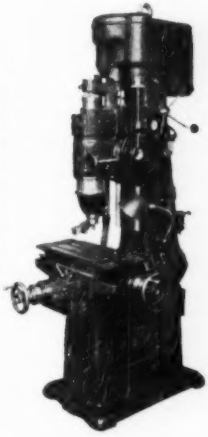
Ben Moreell

BEN MOREELL, *President*
JONES & LAUGHLIN STEEL CORPORATION

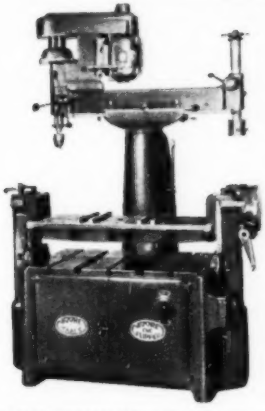


No. 2 MOORE JIG BORER, with its accurate lead screw settings within .0001", offers all the time-proven precision features associated with Moore Jig Borer construction for 15 years, plus numerous labor-saving advantages, including: increased capacity and size; infinitely variable spindle speeds; 3 power feed ratios; centralized controls.

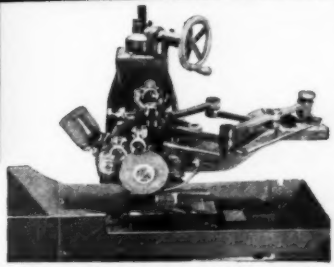
MOORE JIG GRINDER, an important contribution to tool and die-making, meets the growing need for finish-grinding holes to size and location, previously accomplished only by makeshift methods. It eliminates hours of checking on the bench or surface plate to correct holes in hardened parts.



Four ways to cut costs and meet competition by mechanizing your toolroom.



MOORE DIE FLIPPER takes the grunts, groans and wasted motions out of the toolroom. With it one diemaker does the work of three. He can take apart, turn over, drill, tap, try out, and inspect a complete die-set. It's a money saver from the start, for it can also be used as a radial drill.



MOORE PANTO-CRUSH WHEEL DRESSER speeds form-grinding and cuts costs. Both crush-forming and diamond-dressing are accomplished with this 2-in-1 unit permanently mounted on the wheel spindle of a surface grinder. You switch from one method to the other without disturbing workpiece setting

We'll be glad to send you complete descriptive literature on any of these machines.

MOORE SPECIAL TOOL COMPANY, INC.
738 UNION AVENUE, BRIDGEPORT 7, CONNECTICUT

ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTO-CRUSH WHEEL DRESSERS • DIE FLIPPERS • COMPLETE LINE OF HOLE LOCATION ACCESSORIES

Machining Properties of Nylon Rod Suggest Valve Disks, Washers

Wear resistance combined with seating qualities make this rod useful for machining into valve disks. FM-3001 nylon is flexible to conform exactly to the valve's seating surface and has a recovery characteristic which quickly seals the slightest leak.

The FM-1001 rod was selected for precision spacers, washers and bushings because it has a somewhat higher softening point than other thermoplastics, and because nylon is fungus resistant.

The Polymer Corp., 201 Ganster Bldg., Reading, Pa.

Manual Across-the-Line Starters For Single, Polyphase Motors

Bulletin 3151 Size 0 and 1 ac manual across-the-line starters operate with single or polyphase ac motors. Mechanically actuated quick-make and-break switch mechanism is thermal-overload protected. Starter is front-operated and has silver-to-silver double-break contacts. Starters are available in 2-, 3- and 4-pole types. Maximum enclosed 3-phase rating for size 0 starters is 2 hp, 440-550, 60 cycles; for size 1 starters—7½ hp, 440-550 v, 60 cycles.

Ward Leonard Electric Co., Mount Vernon, N. Y.

Midget-Size Rotary Drill Has ¼-in. Capacity in All Metals

This midget-size rotary drill of ¼-in. capacity, the Master Power M-900, is available in free speeds of 1200, 2400 and 4800 rpm for drilling up to and including ¼-in. holes in all materials and metals. Drill weighs 2 lb including ¼-in. capacity three-jaw chuck and is 6⅜ in. in length.

Master Pneumatic Tool Co., Inc., Orwell, Ohio.

WELDING AND BRAZING TORCH has all-braze construction with rear end designed for easy hose connections. The Model AV-10 lightweight torch converts into a cutting torch by use of WC-10 cutting attachment—*The Liquid Carbonic Corp., 3100 South Kedzie Ave., Chicago 23, Ill.*

Copper Electroplating Anode Features Flat Top

This copper flat-top electroplating anode eliminates gates and flash which often causes hanging on baskets. Freedom from cavities prevents inclusions of copper oxide, silica and dirt. Flat top is said to have 20 to 25% more effective area than a ball of the same diameter and more metal per anode, thus reducing loading frequency.

Wagner Bros., Inc., 402 Midland, Detroit 3, Mich.

Indicating Controller Measures, Controls Process Variables

This type of indicating controller named Multi-Switch Capacitrol measures and controls process variables such as temperature, voltage, amperage, pressure, speed, etc. Incorporating a distant view scale, front accessibility, plug-in chassis design and voltage selector plug, it is available with a maximum of four switches to provide a selection of six different switching sequences.

Wheelco Instruments Co., 847 W. Harrison St., Chicago 7, Ill.

Tempilstiks, Pellets for Temperatures from 1600 to 2000 F

Additional high-temperature ratings of Tempilstiks and Tempil pellets cover the range between 1600 and 2000 F. Beginning with 113 F, Tempilstiks and Tempil pellets are now available in 12½° steps to 400 F, and 50° steps from 400 to 2000 F. Tempilaq, the paint form of temperature indicator, is available in similar intervals from 113 to 1600 F.

Tempil Corp., 132 West 22nd St., New York 11, N. Y.

Stability-Tested Grease Available for Bearing Lubrication

Norma G-66 stability-tested grease is now available for bearing lubrication. This ball-and-roller bearing grease provides lubrication of a wide temperature range without separation, drying out or hardening. Compounded grease is resistant to oxidation in storage as well as in service. It is insoluble in water and will not emulsify or aerate in presence of condensed moisture.

Norma-Hoffmann Bearings Corp., Stamford, Conn.

Eutec-Aluminum-Weld Economizer For Welding Below Melting Point

The Eutec-Aluminum-Weld economizer is designed for torch welding of aluminum at temperatures far below melting point of aluminum. The thin-flowing alloy designed for use with special Eutector flux permits lap- and slip-type welds on aluminum. Eutec-Aluminum-Weld, because of its fluid character, bonds readily to the surface. It is suitable for joining thin parts.

Eutectic Welding Alloys Corp., 40 Worth St., New York 13, N. Y.

Batch Immersion Method Used In Industrial Bonding Process

Bonding dissimilar materials in parts designed to withstand extreme lateral or internal hydrostatic or aerostatic pressures is the aim of this process which allows numerous parts to be processed simultaneously.

Process has been primarily developed for bonding plastic or neoprene to metals, or ferrous to non-ferrous metals, as in bushings or inserts used in aircraft, electronic, oil tool, or hydraulic or hydraulic equipment. Microporosity is eliminated by impregnation with the bonding agent. Finished parts show no visible signs of treatment, and anodized, plated, or machined areas are not affected.

Western Sealant Inc., Culver City, Calif.

Welding Alloys Wall Cabinet Available For Small Shops

Specifically designed to service welding needs of small garages, machine shops, plumbers, blacksmiths and farmers, a compact wall cabinet holds a great variety of welding rods in small number.

It accommodates 7 to 9 different types of rods in standard packages, depending on the type of metal to be welded and type of equipment available. One model services those who have only torch welding equipment, another model services those who have only arc welding equipment, and a third type is usable in both arc and torch welding shops.

Cabinet called Eutec-Wall-Pack, is 22x13x3 in. and is easily mounted on the wall.

Eutectic Welding Alloys Corp., 40 Worth St., New York 13, N. Y.

This amusing Nicholson advertisement appeared recently in *The Saturday Evening Post*. It is one of a series that has been running monthly for more than four years.

★ Nicholson and Black Diamond files are, we honestly believe, the best files in the world today. . . . Best for *lasting qualities*. Best for *trueness*—in straightness and even filing surface. Best for *accuracy in cut*. Best for *uniformity in hardness*. Best in *engineering design* for the job and material for which each type, cut and size is intended. Best, therefore, for IMPROVING YOUR WORKMEN'S EFFICIENCY, for INCREASING YOUR PRODUCTION, and for LOWERING YOUR FILING COSTS.

All these are basic reasons which are important controlling factors in selecting the file brand that assures you the *most for your money*. Your industrial distributor will tell you the same things.

FREE TECHNICAL BULLETIN *on special purpose files for Stainless Steel, Brass, Aluminum, Foundry Castings, Die Castings, Lathe Filing, Curved Tooth Files, Precision (Swiss Pattern) Files.*

FREE BOOK, "FILE FILOSOPHY" *(new, sixteenth edition)—an invaluable 48-page illustrated "textbook" on kinds, use and care of files. For production heads, purchasing agents, key mechanics.*

NICHOLSON FILE CO., 12 Acme St., Providence 1, R. I.
(In Canada, Port Hope, Ont.)

NICHOLSON FILES FOR EVERY PURPOSE

Here's where YOU come in

NICHOLSON U.S.A. MADE IN U.S.A. MACHINIST'S G. P.

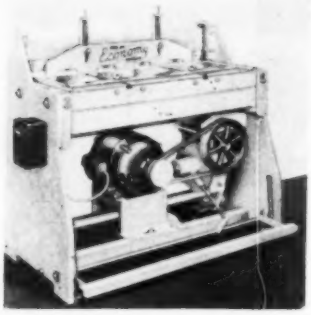
Enlarged view of NICHOLSON MACHINIST'S G. P. *(General Purpose)* FILE . . . Read

a Nicholson file for every purpose

★ . . . and made for longest service per file—utmost value for your money.

"FILE FILOSOPHY" *(new edition!)*, Nicholson's interesting and profusely illustrated 48-page book, tells about scores of regular and special purpose files, their use and care. Send for it. *FREE!*

NICHOLSON U.S.A. and BLACK DIAMOND TRADE MARK

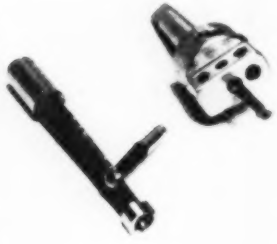


16-Gage Capacity Metal Shear Eliminates Flywheels, Brakes

This power-operated 16-gage capacity metal shear has a self-contained direct-drive unit. The Economy P-16 shear eliminates flywheels, brakes, fast-moving shafts and cam-operated connecting rods by utilizing the direct drive.

One complete revolution is accomplished with each depression of treadle. The cam-actuated rocker arm transmits power to knife blade through two steel connecting rods which are provided with turnbuckles for adjustment. Operating cycle is 60 strokes per min., which can be varied. Shear is available in three cutting lengths, 36, 42 and 52 in. and is powered by a 2-hp. motor in the 36-in. model and 3-hp. motor in the 42- and 52-in. sizes.

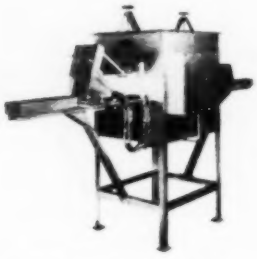
Acme Equipment Co., Inc., 127 S. Clinton St., Chicago, Ill.



Boring Bar Utilized As Double-End Cutter for Holes Reamed to Size

This freer-cutting boring bar is said to have greater diametrical clearance without sacrificing body diameter. It has twice the amount of usable head with the same diametrical clearance, and can be used as a double-end cutter where holes are to be reamed to size. Each lip is used individually until dull. Sharpening is done with a toolmaker's cube on surface grinder. Sizes are ⅛- to 1-in. solid high-speed steel. Two-piece bars are available on ½-in. or larger diameters. Eccentricity and clearance in front are ground after hardening, insuring proper clearance. Tools are to be ground on top of cutting edge only.

A. B. Craley & Son, Clementon, N. J.

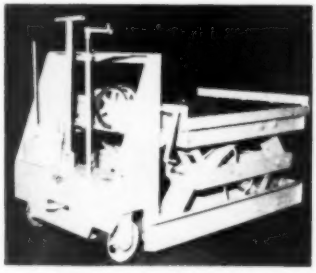


Electric Furnace for Sintering Powdered Metals, Brazing

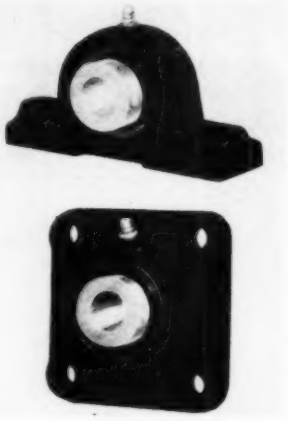
This model SNX electric furna e is designed for sintering powdered metals, brazing, and bright annealing. Normal heat range is 1400 to 2500 F —flash firing, to 2750 F. Unit is a Globar element furnace of the manual-pusher type for batch treatment on a straight-line three-zone system. Work moves from purge or preheat chamber through high-temperature area and then through water-cooled cooling zone.

Both doors are counter-balanced and are equipped with automatically operated flame curtains preventing contamination of furnace atmosphere when doors are open. Unit has high-temperature zone area of 4x4x12 in. Maximum power input is 15 kw.

Pereny Equipment Co., 893 Chambers Road, Columbus 12, Ohio



DIE TRUCK has a 16,000-lb capacity. The hydraulic elevating truck has a 48x57-in. platform. Roller top consists of five rows of rollers placed on 4-in. centers. With roller top in place, platform can be lowered to 24 in. or elevated to 38 in.—*Lyon-Raymond Corp., 2248 Madison Street, Greene, N. Y*

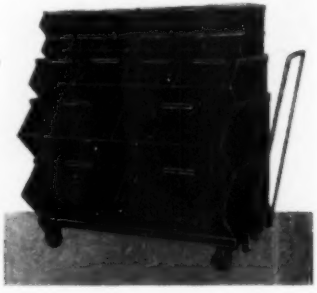


Ball-Bearing Units for Medium Loads, Shaft Speeds to 1000 rpm

This series of ball-bearing units are available for meduim loads and shaft speeds up to 1000 rpm. Both pillow blocks and flange units are available in sizes for shafts from ½- to 1½-in. dia.

The one-piece housings are of heavy - duty cast iron, and are equipped with grease fittings and felt seals for retention of lubricant. Units allow for normal misalignment of shaft. Bearings move in alloy steel races and the inner race is locked on the shaft by two setscrews spaced 90° apart.

Roberts Machine Works, Div. of Minnesota Bearing Co., 1619 Hennepin Ave., Minneapolis 5, Minn.



Stackbin Sections with Truck Are Interlocking Steel Units

These standard stackbin sections with truck are a movable stockroom. Sections are interlocking steel units of 2 to 6 bins in five different sizes. They are made of heavy welded metal with folded edges finished with baked green enamel.

Stackbin Corporation, 1139 Main Street, Pawtucket, R. I.

get this new book

A TECHNICAL
ANALYSIS OF
FAST INDEX HOBS

"Faster Gear Production"

"Faster Gear Production" is a new 20 page booklet prepared by Illinois Tool Works. It presents a careful, thorough analysis of the advantages of Fast Index Hobs and the opportunities for exploiting the full production capacity of your present machine tools. Technical data on finishes, performance characteristics and comparative rates of production in various types of applications are discussed. You will find this specific information, based on actual experience, genuinely helpful—send for your free copy today!

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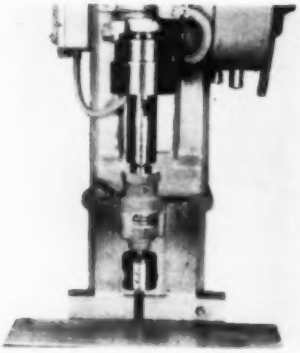
In Canada: Canada Illinois Tools, Ltd., Toronto, Ontario

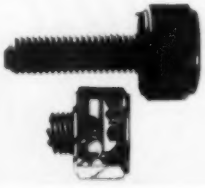
HEADQUARTERS FOR ENGINEERED CUTTING TOOLS



Automatic Reverse-Tapping Unit Has Full-Floating Chuck Jaw

This high-speed wide-range automatic-reverse tapping attachment has full ball-bearing construction. Model is 3½x5½x9 in., weighs 11 lb. It takes hand or machine screw taps from ⅜ to⅞ in., and pipe taps from ¼ to ½ in., in steel. Tapper has a clutch built into the hardened drive and reverse gears, and full-floating chuck jaw to prevent tap breakage due to misalignment.

Dorman Machine Tool Works, 38 South MacQuesten Parkway, Mount Vernon, N. Y.



Adjustable-Torque Thumbscrew Can Be Set to Pressures of 5 to 50 lb

This line of Vlier products includes adjustable - torque thumb screw, spring plungers, spring stops and multi-dimensional fixture keys. The adjustable - torque thumb screw which will hold at proper tension during machining can be set by tool engineers to end pressures of 5 to 50 lb.

Spring plungers provide spring tension action for holding and positioning work on die and jig fixtures, and for other tooling and finishing jobs. They are available in standard sizes with known end spring pressures of 5 to 42 lb.

Spring stops are designed to serve the same purpose as spring plungers in cases where no wall sections are available for threaded mountings. Stops provide a case-hardened steel plunger with a 3/16-in. stroke equipped with flanges which are jig-drilled for bolting to fixture bases. End pressure of 14 lb is provided.

Multi-dimensional fixture keys fit all standard sizes of table slots. Tolerance is said to be 0.005 in. Fixture keys have stepped sides and are simple counterbored hex nuts milled to different cross dimensions.

Vlier Mfg. Co., 4552 Beverly Blvd., Los Angeles 4, Calif.

Cam-, Lever-Actuated Shear By DoAll Cuts Flat Strip Stock

Improved type of cam- and lever-actuated shear cuts off flat strip stock. Chief use is in cutting off bandsaw blade square and flat in preparation for welding into a band. Shear takes blades to 0.045 in. thick and 1¼-in. wide. The new shear eliminates troubles caused by metal-cutting snips. A piece of blade ⅛ in. wide is removed so that an old weld can be cut out, and at the same time, the blade ends are squared in preparation for a new weld. The quick cutting by the shear descending between two knife-edge blades as the strip is positioned eliminates any deformity of material at cut.

The DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.

Webber Gage Block Is Insulated from Body Heat

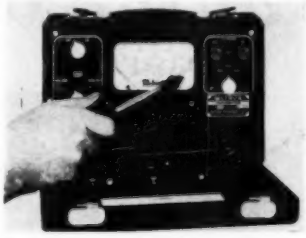
This Thermo Guard gage block is insulated from body heat. Heat transmitted from hands can cause an ordinary 4-in. steel block to grow 0.00005 in. in 15 sec. The Thermo-Guards are inlaid in all 2-, 3- and 4-in. steel and carbide blocks.

Webber Gage Co., 12900 Triskett Road, Cleveland 11, Ohio.

Polishing Machines Utilized With Lathe, Contour Machine

Four single-spindle semi-automatic polishing and buffing machines are used in conjunction with any lathe or contour machine. Two with single rotating spindles and two with rotating stroke-type spindles are claimed to greatly increase production over hand methods for polishing and buffing with wheels or abrasive belts and backstands on such parts as pots, pans, etc.

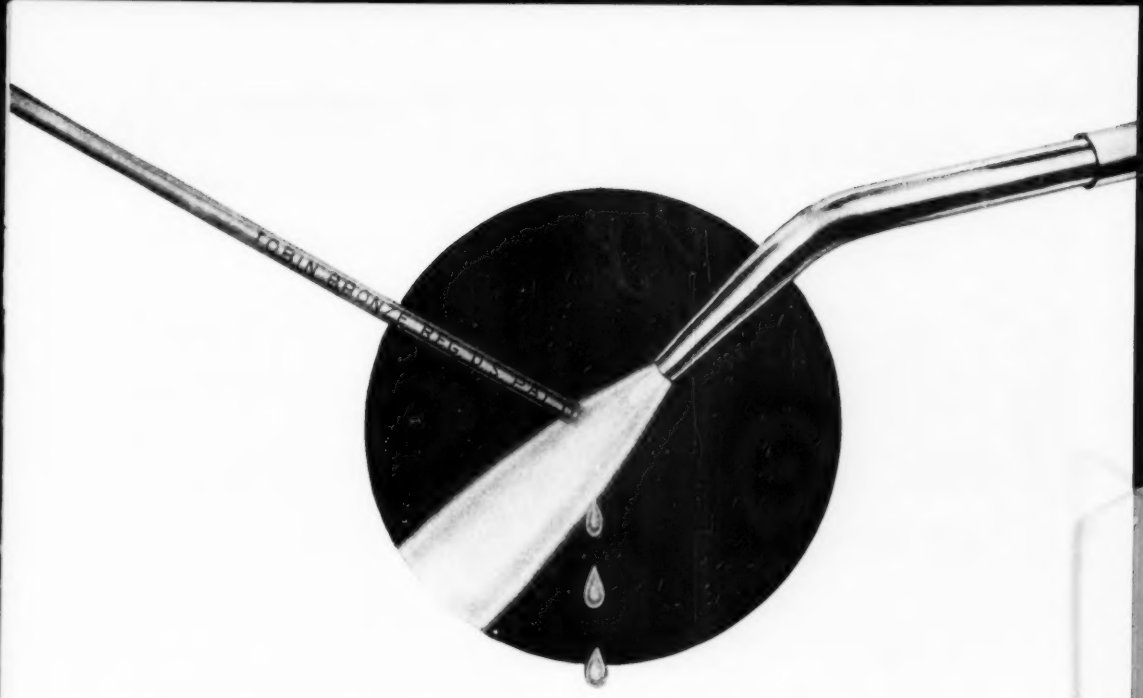
Hammond Machinery Builders, 1630 Douglas Ave., Kalamazoo, Mich.



Series 48 Precision Tachometer By Metron Tests Motors

This type 48K precision tachometer is suited for motor and generator testing. Total speed range without adapters is 360 to 4000 rpm, accommodating all synchoronous or induction motors and most geared-type motors. Head adapters are available for checking high-speed universal motors or extreme low-speed gear motors. Any one of ten ranges is selected by a rotary switch. No damage results from overspeeding up to about 8000 rpm regardless of range setting. Readings are accurate on all ranges to within ¼% of actual speed. High accuracy is obtained by use of bridge-circuit principle.

Metron Instrument Co., 432 Lincoln St., Denver 9, Colo.



Often worth its weight in Gold!

When production groans to a halt because of broken or fractured equipment, many shop-owners would gladly pay the price of gold for the few ounces of bronze needed for a reliable repair-weld.

They don't have to, of course. For repair-welding with Anaconda Bronze Rods—particularly Tobin Bronze*—is a low-cost, low-temperature method of oxyacetylene welding on cast or malleable iron, steel or copper alloys.

Over the decades that time-tried Tobin Bronze has served so well, many "new" rods and procedures have sprung up with mushroom-like growth, only to disappear as quickly—victims of their own lack of dependability!

Whether you do your own repair welding or call on outside help, play it safe—insist on genuine Tobin Bronze.

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut
Subsidiary of Anaconda Copper Mining Company
In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

*Reg. U. S. Pat. Off.

DON'T SCRAP IT . . . BRONZE WELD IT!

Bronze welding is safe, speedy and economical. Large or small, bronze welds are tough and readily machinable, high in strength and low in residual stresses—an ideal combination for repair welding, for building up worn surfaces, and for production welding, too. Tobin Bronze and other Anaconda Welding Rods are described in this NEW, 17th Edition of Publication B-13. Write for a copy.

ANACONDA
from mine to consumer

Anaconda
BRONZE WELDING RODS

Here's Where

HY-PRO taps paid 78 to 1

for a Plastics Manufacturer

PART: Molded Plastic Flat Iron Handle

PROBLEMS: Taps being used to thread blind holes in molded plastic flat iron handles had a maximum life of 500 threaded holes in addition to spoiling many pieces by reaming out holes.

Then They Called in the HY-PRO Sales Engineer

HY-PRO SOLUTION: Hy-Pro's Engineer came up with a tap of special design having their exclusive HARDERNELL surface treatment. Results obtained in this highly abrasive plastic are fantastic—39,000 threaded holes per tap.

Above is a typical example of how the Hy-Pro Sales Engineer can help increase threaded-hole production. His expert engineering counsel backed by the most up-to-date tap production methods combine to solve tapping problems rapidly and profitably.

All Hy-Pro Taps are ground from tough uniform quality high-speed steel and given one of the Hy-Pro exclusive surface treatments.

Each tap is completely inspected by the latest electronic quality control equipment, your assurance that there will be no dimensional variance in Hy-Pro Taps of a stated size.

These precision manufacturing methods plus the ability of the Hy-Pro Sales Engineer to prescribe the correct tap for your particular job means *sustained accuracy* on your production line resulting in higher productivity from your tapping machines.

℞ Let Hy-Pro solve your tapping problem—call a Hy-Pro Sales Engineer today.

Order from your distributor.

HY-PRO TAPS

HY-PRO TOOL CO.

NEW BEDFORD, MASSACHUSETTS

A SUBSIDIARY OF CONTINENTAL SCREW COMPANY

ROUND TABLE *Discussion*

PROSPECTING

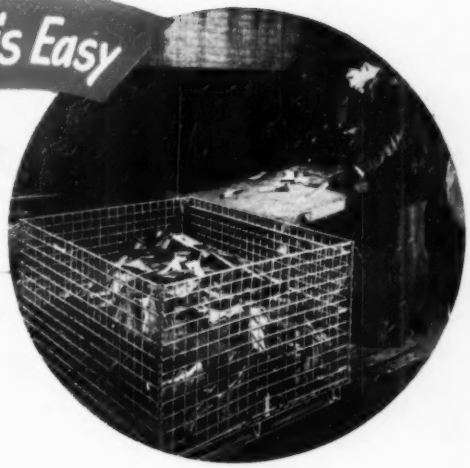
This is still a free country, and a man still has his right to choose where he wishes to work as long as it does not interfere with governmental regulations. The question of looking for a new job on company time has long been discussed, both pro and con. It is gravely doubted if a satisfactory answer has ever been projected from all the discussion. Men, if they are dissatisfied with their jobs, will look elsewhere for work. And why not? After all, the working man spends most of his life earning enough to pay taxes and buy bread for the table. Can any of us condemn him if he can find a better job at more money so long as it is a better job and not just a drifter's dream? Some shops are wonderful to work in; some are fair and others leave a lot to be desired. Frequently it is the management and its policies, generally it is the foreman and his supervision that makes the shop a workable, livable place to spend 8 of each 24 hr.

Should a fellow tell his boss he is dissatisfied and wants to look for a new job? If he does, he'll be outside looking in. How many bosses would let a man continue to work if he was told his job didn't suit? The employee would be given the gate and quickly. Oh yes, management would cover up the deal and make it appear logical, but it would happen nevertheless. So we see that the worker can not do what he would like to do. Most of us would like to shoot squarely with our employer. We would like them to have a fair warning but we want the same fair deal in exchange. This problem, like so many others, causes hard feelings between labor and management. Management is still the "hard-head" who never learns human relations. Management that would just as soon lay a man off today as give him a month's notice hasn't helped our present employer-employee relationship.

It is not right, and both sides have been at fault. Some of us wonder if there ever will be harmony. Can we solve our differences and produce a better industrial world? We can if we will, but not on our present pathway. We are now headed for more and more disaster. We are looking forward to governmental

Your Material Handling is Easy

WITH PITTSBURGH COLLAPSIBLE CARGOTAINERS



From Production Line

The Cargotainer receives parts as they come from machines. Empty Cargotainers are collapsed, take little space, are light-weight, can be kept handy.

To Storage and Shipping

Fork truck takes filled Cargotainer from production to storage, then loads Cargotainer from storage to truck or freight car. There is no re-handling of parts.

To Assembly

Cargotainers are received and stacked ready for assembly line. Inventory is easy—stock always visible. Fork truck delivers to assembly points.

● Write today for free illustrated booklet AM. Pittsburgh Steel Products Company, Grant Building, Pittsburgh 30, Pa.

Pittsburgh Collapsible

Cargotainer

Pittsburgh Steel Products Company

Subsidiary of

Pittsburgh Steel Company

In less than 5 months

PAID for ITSELF

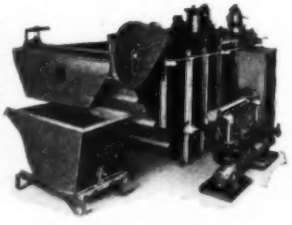
The Actual Savings Record of One Plant Using HOFFMAN Flotation Equipment

Based on One Year's Operation of 7 Centerless Grinders

	BEFORE	AFTER	SAVINGS
Total Shifts Operating	2860 hrs.	2860 hrs.	
Total Wheel Dressing	2860 hrs.	1450 hrs	
Labor for Dressing	$3,646.50	$1,823.25	$1,823.25
Time for Cleaning Coolant Tanks	954 hrs.	NONE	
Labor for Cleaning Coolant Tanks	$1,216.35	NONE	$1,216.35
Grinding Wheels (est.)	$1,556.00	$1,356.00 (est.)	$200.00
Diamonds (est.)	$1,100.00	$900.00 (est.)	$200.00
Soluble Oil	$915.00	$715.00 (est.)	$200.00
MAINTENANCE SAVINGS (Annual)			$3,639.60
PRODUCTION SAVINGS Based on 3,814 hours saved, evaluated at $5.00 per hr. per machine			$19,070.00
TOTAL SAVINGS			$22,709.60
INSTALLED COST of Hoffman Flotation Unit			$9,488.60

Get the Figures for *Your* Operations

Detailed cost records kept by one manufacturer revealed these phenomenal savings with a Hoffman central system for coolant clarification. Along with better quality and faster grinding, this plant saved production labor formerly wasted on cleaning individual sumps. A Hoffman flotation unit provided automatic clarification with the amazing economies shown above. These same cost-cutting economies can be obtained in your plant. Write *today* for literature and a FREE Hoffman filtration engineering survey.



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Larger capacities to your specifications

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control of our work. How can we stop the rapid progress along these lines? One way is by proper education sponsored by industrial management. Educate the worker. Certainly it costs money, but so does the loss of freedom. By becoming the teacher, industry will also benefit through seeing a different problem—that of human relations. Management will learn that the worker has rights and that he doesn't always want something for nothing. If treated in a humane manner, he will react humanely. So until that day comes it is every man for himself.

If you don't like your job, get a new one if you can. However, don't get yourself into the position of where you must look. Companies will do the same if they do not want you—out you will go. Company policy will rule the amount of notice given you.

Let us all hope that some day someone will see the danger ahead and set the brakes. Once stopped, it may be that a new industrial life can be started.

Charles D. Townsend
Centralia, Mo.

●

HARD SENSE OR HARD HEAD

Why, because a mechanic was hired to run a turret lathe or a certain machine in the shop, should he be excluded from helping with the progress of the work that surrounds him? If he is a true employee, he not only will give his best, if given the chance, but will receive much personal enjoyment from the mutual feeling of companionship derived from the group, rather than the individual planning. In many plants, this system is worked out in the form of suggestion boxes, and has proved worthwhile in many difficult problems.

The ideal time to find some of the desirable answers is the noon "bull session" held during the lunch hour. This is one of the opportune times to feel out the "gang" and discover any hidden talent that may be there. If the answer can be found, the owner of the solution may be allowed to work on the project or at least know that proper recognition will be received. It is my experience that if the proper attitude is taken towards the contribution, and not a "stealing of the other guy's efforts" as is done in so many places, there will be one followed by many more contributions of value to the entire firm.

The thought is also brought up that the men would figure that the "brass hats" of the concern were stuck and had to call on them for assistance,

For Aluminum Bronze Weld Deposits of

high strength, high ductility and good corrosion resistance

on bronzes, cast and malleable iron and dissimilar metals

Specify AIRCO NO. 100 ELECTRODE

The Airco No. 100 is a shielded arc, general-purpose, aluminum bronze electrode for flat and horizontal welding with D-C, reversed polarity.

This popular electrode is used for producing sound, clean welds having high mechanical properties on bronzes, Muntz Metal and brass . . . and also on malleable iron, clean cast iron and steel.

For welding harder grades of aluminum bronze — in the flat position with D-C, reversed polarity — Airco Nos. 116, 120, 125 and 130 Electrodes are used for their properties as non-ferrous, hard, overlay deposits — which are corrosion and acid resistant.

For more information on Airco No. 100, as well as Nos. 116, 120, 125 and 130 Electrodes, write your name and address on the margin below and send it to your nearest Airco office or authorized dealer for a copy of Catalog No. ADC-650A.

* * *

Air Reduction supplies Oxygen, Acetylene and other industrial gases . . . Carbide . . . and a complete line of gas cutting machines, gas welding apparatus and supplies, plus arc welders, electrodes and accessories. Ask us about anything pertaining to gas welding and cutting, and arc welding . . . we'll be glad to help you.

More news about AIRCO products

STAINLESS STEEL ELECTRODES

Over 25 different types to fit most any problem involving the welding of stainless steels. For application with D-C, reversed polarity most electrodes are furnished with a heavy extruded lime type coating. For all position A-C or D-C application all but the straight chrome analysis are obtainable with an extruded titania type coating.

HORNET 36A D-C WELDER

A heavy-duty, high-speed, light-weight machine designed to furnish smooth, steady current for every D-C arc welding job — even under severe operating conditions. 200, 300 and 400 ampere sizes are available.

BUMBLEBEE A-C WELDER

This machine is known for its improved electrical efficiency at rated loads, wide current range, low open circuit voltage (75 volts), vastly improved power factor, quiet operation and minimum maintenance. There is a size available for every A-C welding purpose.

ELECTRODE HOLDERS

A complete line of Jackson tong type and Martin Wells screw type holders are available in various amperages and sizes.

AIRCO AIR REDUCTION

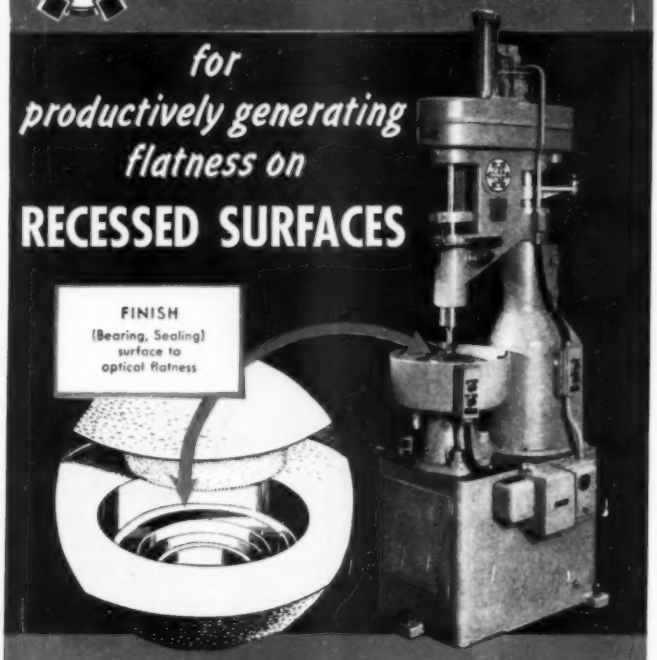
Offices in Principal Cities

MICRO MATIC

MICROFLAT

for productively generating flatness on

RECESSED SURFACES



● Microflat machines may be equipped to finish recessed surfaces.

The location of a surface does not limit the application of the MICROFLAT machines. Any surface that can be machined can be finished with this equipment. The surface finish and flatness generated can be controlled and held to any specified requirement.

The machine shown above is equipped with a timer and an air cylinder. The operator loads the part into the fixture and starts the cycle. The fixture rotates, the bonded abrasive finishing surface oscillates and rotates. At the end of a predetermined time cycle the spindle automatically withdraws. Production is 300 pieces per hour.

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and that this would not add to the efficiency of the shop. I do not believe that any man, if given the recognition deserved for the task, would feel superior to his leaders because of mutual assistance on the job. One of the great findings of World War II, was the fact that the "little men of America" were the initial hands behind the final blast of the guns. If it had been left to a select few foremen and heads of departments, we would still be fighting a tough enemy, but the planning came from all of the people of the nation and turned out as a huge success, so why should any individual working be different from the gigantic task completed by the mass of people?

The expression is often used that "to see the trees you must get out of the forest." This is also true of any job you may tackle. One man may be so surrounded by the workings of special detail that he will overlook the answer, although it is very obvious to an outsider. If this "onlooker" were permitted to add his opinion without the danger of speaking out of turn, both valuable time and material might be the saving.

In my estimation, the best answer to any seemingly unsolvable problem would be a verbal suggestion box. This would not only bring to bear all of the thoughts of the group on the problem at stake, but would, by common sense of getting to know your fellow worker, bring a deeper feeling of understanding and enjoyment among the workers and their superiors. This in turn would effect largely the productive output because of the relationship of mental attitudes and working attitudes. If a man is happy in his job, the work prospers from his interest; whereas, if a man is discontented, his efforts will naturally follow his fine thinking. As Al has said, "pride goeth before a fall," so has many a man failed because of a false sense of pride. If a man is fearful of his personal pride in connection with his work, he is putting his own feelings in front of the success or failure of the job he has been hired to perform.

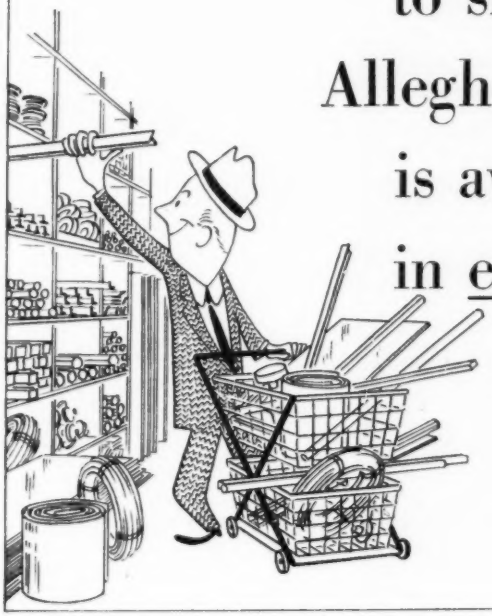
Jack Bell
Bakersfield, Calif.

•

One day I was laying out for the works manager a hydraulic system for a special machine. He watched me pore through various handbooks and catalogs, making calculations and scratching my head.

"No engineer knows everything," he said, "but if he has to, he can do what you are doing and come up with something. There are special-

You don't have to shop around . . . Allegheny Stainless is available in every form you may need



WHATEVER you want, it's available in Allegheny Metal—from the finest of wire to heavy plates, castings and forgings, including sheets, strip, bars, shapes, tubes—*everything!*

That's not only handy, but advantageous: one reliable source, one undivided responsibility, one well-known standard of quality and uniformity. Furthermore, we're steadily improving supply facilities—you can get Allegheny Metal promptly in any grade, form or finish.

When you're in the market, keep it in mind to specify Allegheny Metal, the pioneer stainless steel. And remember, wherever you use it, Allegheny Metal looks better, lasts longer, works out to be cheapest in the long run.

Complete technical and fabricating data—engineering help, too—yours for the asking.

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The Nation's Leading Producer of Stainless Steel in All Forms

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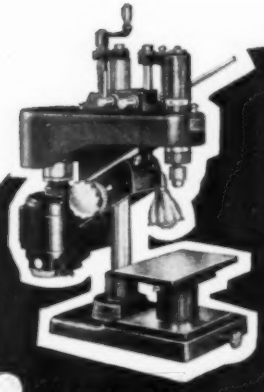
Allegheny Metal is stocked by all Jos. T. Ryerson & Son, Inc., Warehouses



SMALL HOLE

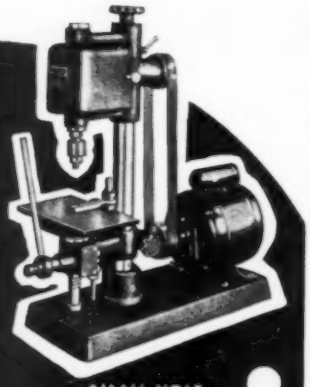
PRECISION DRILL

SUPER-SENSITIVE
VARIABLE-SPEED

The Hamilton Varimatic Drill has stamina. All of the stamina needed for hard, continuous production work. But it is also a tool of precisinn, built to extra close tolerances for the drilling of small, precision holes (.004" to 5/16") in materials as diverse as paper and monel or ceramic and bronze.

Speed is infinitely variable between 840 R.P.M. and 9300 R.P.M. Clearance from center of chuck to column is 5", from table to chuck, 9½".

Our bulletins V-47 and T-47 illustrate and explain these two precision machines in detail. Write for them!



SMALL HOLE

PRECISION TAPPER

COMPANION TOOL
TO THE VARIMATIC DRILL

SUPER-SENSITIVE

The spindle of the Hamilton Super-Sensitive Tapper idles in reverse, and thus may be centered without cutting. When pressure is applied to tap, direction of rotation changes and tapping begins. Release of pressure again reverses rotation and reduces speed to "idle" instantly and automatically, withdrawing tap from hole.

This feature, and the tapper's adjustable stops, make possible the tapping of blind holes to the very bottom without danger of tap breakage and in a minimum of time.

Capacity of the Hamilton Tapper is from the smallest and finest tap to 10-32 inclusive. Spindle speeds range from 1200 R.P.M. to 2600 R.P.M. Clearances; center of chuck to column, 3¼", and from table to chuck, 3¾".

THE Hamilton TOOL COMPANY

SUPER SENSITIVE DRILLING MACHINES
TAPPING MACHINES · PORTELVATORS

830 SO. NINTH STREET • HAMILTON • OHIO • U • S • A

ists in every line. These men spend most of their lives studying, designing, and installing specific units for various applications. For instance, you want a pump to run for 24 hours a day, pumping oil at a required pressure to a machine a certain distance from the reservoir. Now I've been an engineer for over 20 years and I never had to design a hydraulic system; in fact, I'm not so sure I'd know where to start, but not many engineers know our line of business and what is common knowledge or daily routine to us in our field is complicated to another engineer not acquainted with it."

"Instead of involving yourself in a mess of calculations and brushing up on your college hydraulics, why not contact someone who is in that field and let him strut his stuff?"

He picked up a telephone directory and called two pump companies, asking them to send a representative. In a day or so, one of the representatives called and I explained our problem. He drew a schematic sketch of his solution and by using a special pocketbook of tables, listed the size of pipe necessary, size of the reservoir, number and type of valves, volume of oil necessary, size and type and motor. He also recommended an alternative method and gave me an estimated cost of each system. That afternoon the other representative called and we went through the same procedure. These men accomplished in one hour what would have taken me a few days.

About a month later we decided to install a hot cleaning tank for cleaning brass pieces. A representative from a steel company designed the tank, another representative designed the heating controls and type of burner, and a chemical salesman recommended which solution to use for the purpose.

By using the same procedure, the foreman can accomplish the same results. Instead of "batting his brains out" on a special job, he should drag in one of his men who has some experience on a similar job and get his ideas. I worked for a jobbing shop where the foreman wouldn't try to figure a job. He'd show the print to each man and ask him if he could handle it. The one that accepted it would do all the brain work. After the foreman walked away, the other men would gather about the volunteer and offer suggestions. One of the young fellows would bring the print home and get suggestions from his father and older brother who were machinists employed elsewhere.

Another foreman I knew would

To produce many thousands of cast bronze bearings day after day, to the uniformly high quality synonymous with the name Bunting requires precise foundry control. This control starts with the raw materials necessary for production such as molding and core materials, core binders, fixed carbon fuel, pre-alloyed metal in ingot form purchased to Bunting's own rigid specifications, and virgin metals used for ladle additions to control metal composition. Then, too, melting and casting procedures are carefully controlled.

Trained foundry and laboratory personnel as well as chemical and metallurgical equipment of the latest design are required to carry on this exact control. Bunting has always taken pride in being the leading producer of bearing bronze of the highest quality and has the facilities to maintain this leadership. The Bunting Brass & Bronze Company, Toledo 9, Ohio. Branches in principal cities.

Bunting®

BRONZE BEARINGS

BUSHINGS

PRECISION BRONZE BARS

88

Order **JOHNSON BRONZE BARS** *in exact sizes required*

EVERY bar of Johnson Universal Bronze is completely machined . . . inside diameter . . . outside diameter . . . and ends. This saves you machining and tools, and guards against possible under-surface defects. Every bar is usable from end to end. Further, you buy no unnecessary weight . . . another saving. Johnson Universal Bronze is a high quality, general purpose bearing alloy cast in bar form. It is economical to use . . . easy to machine . . . and will give long, efficient service. Order from your local Johnson Bronze distributor . . . or from a factory branch near you.

Johnson Bronze
SLEEVE BEARING HEADQUARTERS
515 SOUTH MILL STREET · NEW CASTLE, PA.

keep the tough ones on his desk and when interviewing job applicants, would show them the print and ask them how they would handle the job. Although he didn't hire them he got some good suggestions gratis.

Once when I was doing some development work, I wanted to use a piece of leather on a fixture. Not knowing the properties of leather, I consulted with the shop porter who was formerly a shoemaker. I used the type of leather he recommended and every time he swept the floor under that piece of mechanism he would examine the leather to see how it was standing up.

Frank J. Zarnowski
Rutherford, N. J.

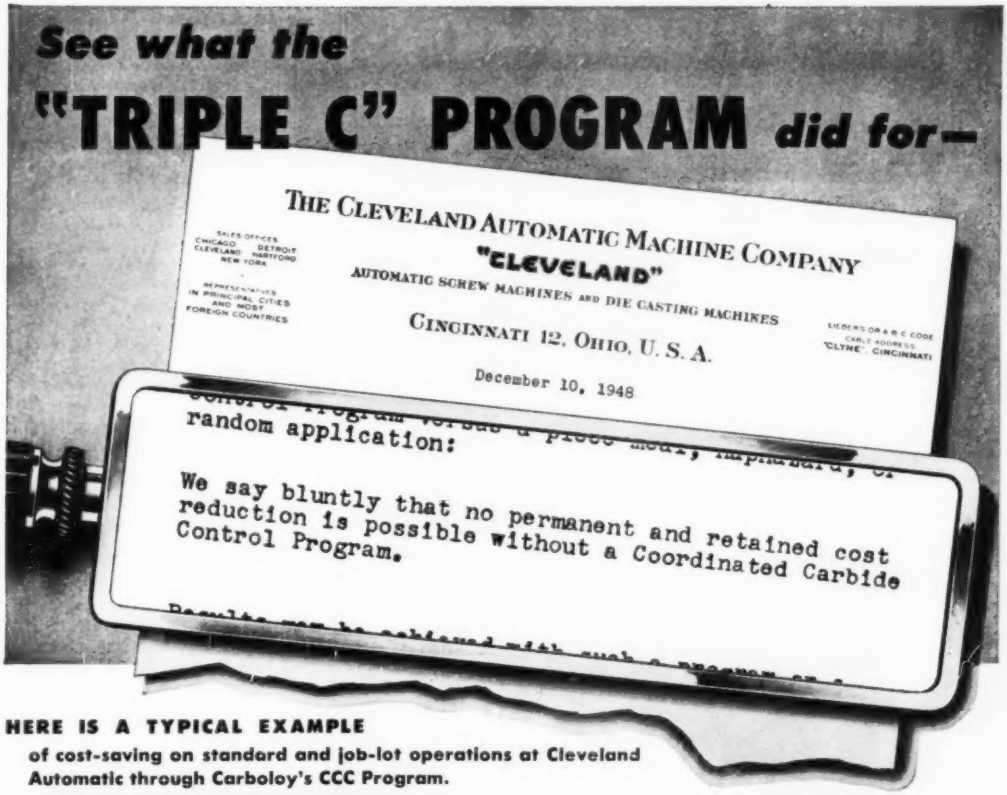
•

"A friend in need is a friend indeed" is a good maxim for every foreman to remember. Carrying this sentiment a step further in its application to the foreman-worker relationship, the wise foreman will not only be a good friend of the workers by making it his business to know the special experience and capabilities of his men, but will not hesitate to call on that special experience when needed. The special-experience employee can truly be the foreman's friend when the special occasion arises.

In the problem under discussion, the foreman's good hard sense should guide him and preclude any hesitation in going direct to the experienced man in an endeavor to find a solution to the phase of die construction under study. He will not lose face doing so. Inquiring about what one does not know is a sign of strength, not weakness.

Of course, in the opinion of some self-exalted executive the question may naturally be present as to how a foreman can maintain his prestige when he has to call in "shop help" to aid him on a matter which he is having difficulty in solving. It is believed, however, that the foreman who puts forth the necessary time and effort to render an intelligent decision but finds he needs special help from an experienced worker should in no way feel ashamed to consult an employee of long experience about the special knowledge needed for the problem's solution. Far from losing prestige he will gain respect. A good employee knows that the foreman does not have all the answers, could not have them, and is not expected to have them. Moreover, there is a subtle compliment, to which nearly everyone responds, in asking for advice. Having given the foreman advice, the desire is implanted in the adviser

See what the "TRIPLE C" PROGRAM did for—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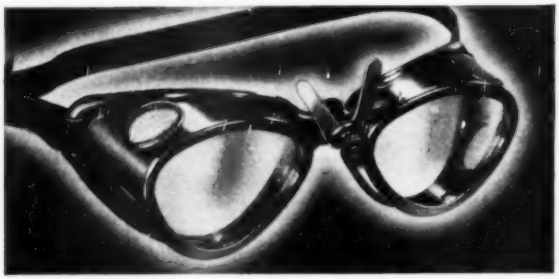

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to see that the advice proves sound. We are predisposed to those whom we have advised.

There is no substitute for experience. A man experienced and skilled in an occupation which he has followed for many years usually has many special capabilities over and above the general requirements of his job. He usually has acquired those attributes of mature experience such as dependability, resourcefulness, and the willingness to give extra effort in time of emergency. A treasure-trove of diversified experience usually characterizes such valuable employees. However, the potential and actual power of such workers is lost, if the foreman is hesitant in using it. There's where the rub lies. For, what better way of getting help on a knotty problem could be devised than the utilization of the specialized experience and mechanical propensities of the specialist available under the misleading label of "shop help." Aside from obtaining pertinent technical advice, the fact that the worker is called upon for his valued opinion will help build employee morale. The worker will feel that the supervisor is making an effort to make him realize that he is a part of the company. A good boss keeps his good men doing good work by helping them to feel more proud of themselves. He treats them as important individuals and helps them feel that their best effort will be important to the company.

A foreman should find out, through personal contact, the extent of mechanical knowledge, ability to use that knowledge, special qualifications, and general temperament of each of the workmen under his supervision. It is too much to expect from a foreman that he know the last word on a special job, but he should know who are the specialists on various machines and lines of work in his own squad that are available to him. Where such is the case, the foreman is shortsighted if he does not make use of these local talents. The workman should be given the opportunity to use his specialized knowledge wherever and whenever it can be applied. His reward is in feeling that his talent is being recognized. A worker who has initiative will welcome the opportunity to use it in exchanging ideas and experiences with the foreman in developing a solution to a tough problem requiring specialized knowledge.

Too many people quit looking for work when they find a job because their bosses fail to capitalize on their

FREE LITERATURE

New Catalogs, Booklets, Bulletins

MACHINES AND ATTACHMENTS

1 GEAR SHAVER — *National Broach and Machine Co., 5400 St. Jean, Detroit 13, Mich.* 20-page booklet describes principles involved in rotary shaving and is thoroughly illustrated. Drawings are included.

2 BROACH SHARPENER — *Colonial Broach Co., Harper Station, Detroit 13, Mich.* Bulletin describes addition to its line of eight broach sharpeners, the Model CS4-16 Universal Broach sharpener, for both round and flat broaches. Machine includes "step-stop" micro-feed control.

3 DIE POLISHING MACHINE—*The Hartford Special Machinery Co., Hartford 5, Conn.* 4-page bulletin PM-100 describes die-polishing machine which polishes dies substantially parallel with line of draw work through die. Machine No. 2 takes ¼- to 3½-in. OD work, while machine No. 3 takes from 2½- to 9-in. OD work.

4 STRAIGHTENING PRESSES — *American Broach and Machine Co., Ann Arbor, Mich.* 4-page folder 215 covers the American hydraulic straightening presses, of 15-, 25-, 35-, and 50-ton capacities. It is illustrated with photographs of machines, hydraulic units and special equipment.

5 SURFACE GRINDERS — *Gallmeyer & Livingston Co., Grand Rapids, Mich.* 16-page pamphlet covers cross-traveling head-type surface grinders. The Model F cross-traveling head-type surface grinders are attainable with 16-, 18-, 20- and 24-in. widths of table and in lengths ranging from 48 to 72 in. Also a 4-page folder is included on the No. 20 hand-feed surface grinder.

6 DIE-CASTING MACHINES—*Miller-Taylor Tool Co., Cleveland 3, Ohio.* 22-page booklet covers the Cast-Master instantaneous high-pressure injection system, producing concentrated non-porous high-tensile castings. Various models for different materials are illustrated and described.

7 LATHES — *Logan Engineering Co., Chicago 30, Ill.* 12-page pamphlet contains information on the Logan 11-in. lathe with 1-in. collet capacity, and 1⅜-in spindle holes. Other lathes are illustrated as well as the Logan 8-in. shaper.

8 PRESS REBUILDING—*Verson All-steel Press Co., Chicago 19, Ill.* 12-page bulletin gives detailed description of facilities for rebuilding presses and shows typical assemblies of presses rebuilt by Verson.

9 PRESSES—*Elmes Engineering Works, Chicago 7, Ill.* 12-page Bulletin No. 1010B covers hydraulic metal working presses. Electric control gives semi-automatic operation, automatic operation, and inching with speed change and reversal of slide governed either by ram travel or pressure, whichever is preferable.

10 RIVETERS — *Hanna Engineering Works, Chicago 22, Ill.* 16-page bulletin 246 covers the Hanna Rapid Riveters available in a wide range of sizes in capacities from 6 to 20 tons, and capable of driving 3/16-in. to ⅝-in. rivets cold. Cold riveting data is included.

11 HONING MACHINES — *The C. Allen Fulmer Co., Cincinnati, Ohio.* 10-page folder covers the Fulmer honing machines which can remove stock from internal cylinders, ⅛ to 30 in. in diameter to a degree of accuracy ±0.0001-in. tolerance on size, straightness, and roundness.

12 MICRO-CENTRIC GRINDING MACHINES—*Cincinnati Grinders, Inc. Cincinnati 9, Ohio.* 16-page bulletin G-573 covers the Filmatic Nos. 1 and 2 Micro-centric grinding machines which can be used for cylindrical and related shapes, generated by revolution. Machine will, without centers or a chuck, hold roundness under 0.000025 in.

13 AIR POWER—*Mead Specialties Co., Chicago 41, Ill.* 48-page catalog covers Mead air-operated devices including various air cylinders, air presses, collets, fixtures, speeders and feeds, hammers, valves, and accessories.

14 TANGENT BENDERS — *Struthers Wells Corp., Titusville, Pa.* 26-page spirally bound catalog T-1210 shows various tangent benders for workable metal either cold or hot.

15 HYDRAULIC RADIALS — *The Fosdick Machine Tool Co., Cincinnati, Ohio.* 28-page bulletin 36 covers the Economax Hydraulic Radials. To reduce set-up time Fosdick has interlocked clamping of head and clamping of column with engaging of feed mechanisms.

TOOLS AND ACCESSORIES

16 TOOLS—*Shilsam, Inc., Chicago, 10, Ill.* 24-page catalog 49-1 covers the Skil Tools and includes blowers and suction cleaners, drills, extension cords and connectors, grinders, lubricants, nut runners, pneumatic tools, sanders, saws, screwdrivers and metal-cutting shafts, etc.

17 PORTABLE POWER TOOLS — *Mall Tool Co., Chicago, Ill.* 18-page folder covers the company's line of drills and attachments, and other portable power tools.

18 FLEXIBLE SHAFTS — *Wyssenbach & Staff, Inc., Chicago, Ill.* 30-page folder 47 contains information on the various sizes and styles of Wyco flexible shafts.

19 DIE SETS AND ACCESSORIES—*Standard Die Set Manufacturers Inc., Providence 7, R.I.* 24-page catalog covers large-size die sets, special shapes and machining, bolster plates, catalog die sets, various bushings, set screws and cap screws, etc.

20 AUTOMATIC RECESSING TOOLS —*Scully-Jones & Co., Chicago 8, Ill.* 25-page manual covers applications, operation, construction and advantages of automatic recessing tools. Tools perform such operations as internal grooves, undercuts and recesses in castings, forgings or molded parts.

21 SUPPLEMENT TO TOOL CATALOG—*Carboloy & Co., Inc., Detroit 32, Mich.* 4-page Supplement 7 to its general tool catalog GT 200, covers the expanded line of company's mechanically held solid-carbide insert tools. Among new additions are triangular insert tools for facing and for plunge turning.

22 HEX TURRETS—*Enco Mfg. Co., Chicago 39, Ill.* 16-page pamphlet covers tool post and tailstock hex turrets. Charts cover various manufacturers' specifications. Various types of turret toolposts are discussed.

23 OIL PURIFIERS — OIL AND COOLANT CLARIFIERS—*Homes-Crane Corp., Lebanon, Ind.* 64-page booklet discusses the Hosan-Crane equipment, which includes oil purifiers, oil and coolant clarifiers, mobile coolant filters, sump cleaners, Flavolators and the Houdaille conveyor. Products are illustrated and specifications as well as tables are given.

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24 SYNTHETIC LUBRICANTS—*Carbide & Carbon Chemicals Corp., Unit of Union Carbide and Carbon Corp., New York 17, N.Y.* 28-page booklet 6500 called Ucon brand fluids and lubricants covers synthetic lubricants for industrial application. Lubricants can be used for machinery, gears, internal combustion engines, etc.

25 DYNALOG INSTRUMENTS—*Foxboro Co., Foxboro, Mass.* 32-page bulletin 427 presents the complete line of Dynalog instruments for process measurement and control, as well as various auxiliary devices which adapt these instruments to many industrial applications.

26 BORING TOOLS—*Industrial Carbide Tool Co., Worcester, Mass.* 6-page bulletin 3-125 lists single-point solid-rod boring tools and includes reference charts for boring-tool applications.

27 CUTTING TOOLS—*Electrolized Tap Corporation, Providence 1, R.I.* 56-page catalog 3 illustrates and describes line of electrolized taps, twist drills, reamers and end mills.

28 TOOLGRAPH—*Illinois Tool Works, Chicago 39, Ill.* 8-page folder presents the Toolgraph chart, an electrically recorded lead chart for each job. The chart is produced by an automatic recording system independent of operator. Record shows exact location of each tool on a hob in relation to all other teeth, and in relation to a desired theoretical lead helix.

29 THREAD-CUTTING SCREWS — *Shakeproof Inc., Div. of Illinois Tool Works, Chicago 39, Ill.* 6-page folder covers the Shakeproof thread-cutting screws which eliminates separate tapping and provides strong fastenings at the same time.

30 KEYWAY DESIGN — *International Nickel Co. Inc., New York 5, N.Y.* 8-page booklet entitled "How to Get the Most from Your New Monel Shaft," describes tests on both conventional-type keyway and on new design with rounded root corners. The booklet includes technical information on milling practice and on best types of cutters to use.

31 STOP CORROSION WITH METALLIZING — *Metallizing Engineering Co. Inc., Long Island City 1, N.Y.* 8-page bulletin gives information and illustrates various uses of metallizing. Specific cases are covered.

HEAT TREATING AND WELDING

32 FURNACES—*Cooley Electric Mfg. Corp., Indianapolis 7, Ind.* 8-page pamphlet is entitled "Shop Notes on Heat-Treating of Steels". It includes: simplicity of heat-treating with an electric furnace, definitions, typical heat-treating procedure, and tips on better heat-treating.

33 WELDING ACCESSORIES — *Air Reduction Sales Co., New York 17, N.Y.* 15-page catalog covers both oxyacetylene and electric arc accessories including goggles, hose, spark lighters, gloves, electrode holders, cables, weld cleaning tools, etc. The two-color catalog has over 50 photographs.

PLANT SERVICE EQUIPMENT

34 LOAD LIFTER ELECTRIC HOISTS — *Manning, Maxwell & Moore Co., Inc., Muskegon, Mich.* 36-page catalog contains illustrations, descriptions, outlined dimensions, and lists of sizes. Hoists come in sizes to lift up to 20 tons in all combinations.

35 LIFT TRUCKS — *Barrett-Cravens Co., Chicago 9, Ill.* 8-page bulletin 4861 presents the improved Barrett OX line of lift trucks, with both lift and travel electrically operated. Models handle heavy skid, pallet and truck loads. Pallet Ox is an electric lift truck of 4000- to 6000-lb capacity, and is available with lifting platform 20 to 25 in. wide.

36 PALLETS — *National Pallet Corp., Pittsburgh 22, Pa.* 16-page catalog entitled "National Pallets" illustrates and describes many types of wooden pallets and includes a map showing location of National's pallet mills throughout the country.

37 SPECIAL APPARATUS — *L. O. Koven & Bro. Inc., Jersey City, N.J.* 24-page booklet 490 illustrates Koven's facilities for special and standard equipment and apparatus for processing, material handling, and storage, for all industries.

PARTS AND MATERIALS

38 SPRAWELD WIRE — *Wall Colmonoy Corp., Detroit 3, Mich.* 7-page folder contains information on the hard-facing Spraweld wire for executing the Colmonoy Spraweld process, a method combining welding and metallizing procedures. The wire is designed for use in standard metallizing guns. Booklet contains application instructions, surface preparation, etc.

39 LOW-TEMPERATURE ALLOY — *Cerro de Pasco Copper Corp., New York, N.Y.* 36-page booklet covers the Cerromatrix alloy, a low-temperature alloy. Alloy is composed of bismuth, lead, tin and antimony, that expands slightly on solidification.

40 CARBORUNDUM—*The Carborundum Co., Niagara Falls, N.Y.* 32-page, two-color book entitled "The Finest in Coated Products—Carborundum," is illustrated with dry brush drawings and describes the closely controlled methods employed to assure production of quality abrasives.

41 GRINDING NON-FERROUS CAST-ALLOY CUTTING TOOLS—*Norton Co., Worcester 6, Mass.* 30-page booklet covers grinding of non-ferrous cast-alloy cuttting tools and includes characteristics of alloys, wheels for grinding cast-alloy cutting tools, sharpening single-point tools, sharpening inserted-blade face-milling cutters, etc.

42 PNEUMATIC CYLINDERS—*James L. Eastwick Co., Pawtucket, R.I.* 12-page catalog 28 discusses pneumatic cylinders. Cylinders are designed for lower-cost operation. The non-rotating, non-cushioned cylinders have bore sizes from 1¼ to 10 in. in diameter, and operating pressures up to 110 psi.

43 STAMPING—*Heintz Manufacturing Co., Philadelphia 20, Pa.* 42-page book offered to company presidents and works managers shows Heintz press shops that produce stampings for various industries; machine shops for building tools; jobbing shops for sheet-metal assemblies; how complete products are manufactured for distributors; metal-finishing and enameling departments, and a research and development service on a contract basis.

44 STRESSPROOF STEEL— *La Salle Steel Co., Chicago 80, Ill.* 32-page folder discusses properties of stressproof steel. A cold-finished steel bar combines in a single steel properties of strength, wear resistance, minimum warpage and good machinability. Information on specific uses such as gears, screws, shafts, etc., is given.

45 VALVES — *Hanna Engineering Works, Chicago, Ill.* 16-page catalog 251 contains information on Hanna precision valves and includes illustrations, descriptions, specifications and features of the complete line.

46 INDUSTRIAL PAINTS — *U. S. Gutta Percha Paint Co., Providence, R.I.* 28-page booklet entitled "Engineered Painting" offers a coordinated plan for plant painting to boost production and cut maintenance costs. Contents include a section on relationship of light and paint in creating good seeing and working conditions.

47 RUST-OLEUM—*Rust-Oleum Corp., Evanston, Ill.* 16-page booklet gives directions for use and application of various types of Rust-Oleum coatings, for example, long oil type, short oil type. Samples with description, application, resistant qualities, drying time and primer information are given on many different types.

48 SOCKET-SCREW PRODUCTS — *Brighton Screw and Mfg. Co., Cincinnati, Ohio.* 16-page catalog 23 presents complete line of E-Right-On socket-screw products with latest price list and specifications, as well as dimensional data. Advance design of products and hexagon keys is illustrated in cut-away and diagrammatic fashion.

49 FIXTURE CLAMPS—*West Point Mfg. Co., Farmington, Mich.* 66-page booklet is a series of templet drawings of Wespo fixture clamps.

50 AIR VALVES—*Gerotor May Corp., Baltimore 3, Md.* 18-page catalog 301, in two colors, describes 21 models which make up the complete line of Gerotor four-way air valve. Description includes working drawings, specifications for sizes and cut-away views. Five sizes are available, ¼, ⅜, ½, ¾ and 1 in.

51 SOCKET-SCREW PRODUCTS — *Safety Socket Screw Co., Chicago, Ill.* 26-page indexed booklet covers the Blue Devil socket-screw products including socket-head cap screws, setscrews, socket stripper bolts, etc.

52 ALLOY-STEEL BARS — *La Salle Steel Co., Chicago 80, Ill.* Covers machining alloy parts 25% faster with La-Sulphite 8640 cold-finished alloy steel bars. Tool life is said to be increased 40%.

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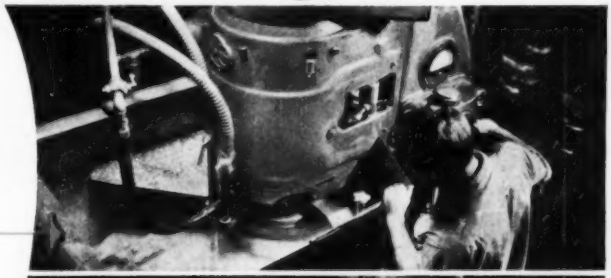
we eliminated warping of cast iron parts



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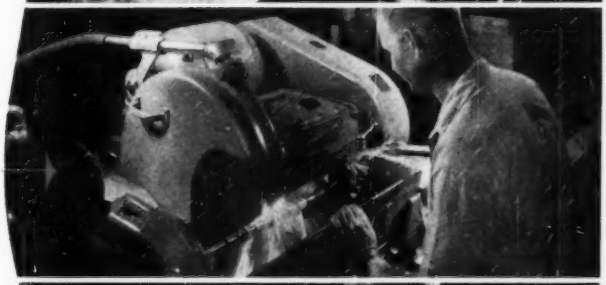
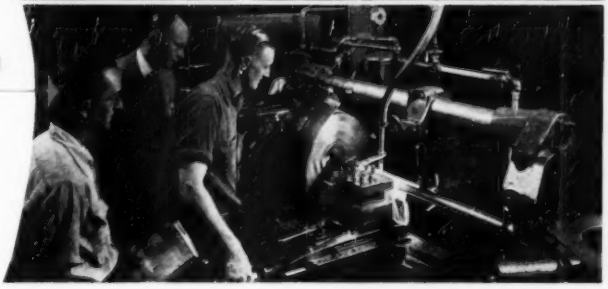


greater production" ... says this foreman



Machine Shop Foreman of a New England manufacturing plant consults with a Gulf Lubrication Engineer on results obtained with Gulf Soluble Cutting Oil on turret lathe work. (Above) This quality cutting oil is also used in this plant in surface and cylindrical grinders.

"We've improved our over-all production picture every month since we adopted Gulf Soluble Cutting Oil," says this Machine Shop Foreman. "For example: Gulf Soluble Cutting Oil eliminated warping of cast iron parts on our surface grinders —wheels cut cleaner and cooler, show less wear. On cylindrical grinders we've improved wheel life and eliminated wheel loading. On turret lathe work we have stepped up production, increased tool life."

Gulf Soluble Cutting Oil meets today's demands for a cooling and lubricating fluid which will do a better job over a wide range of turning, milling, grinding, and many other machining operations.

For further information on Gulf Soluble Cutting Oil—and for one of Gulf's practical slide-rule-type calculators, which will help you maintain desired soluble oil concentrations—send the coupon below.

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LAMINUM* Shims give .002 inch accuracy WITH AS MUCH AS .063 inch tolerance

PRECISION ADJUSTMENTS by simply peeling .002 or .003 inch laminations. *LAMINUM* shims available in thicknesses from .006 to .126 inch.

...cutting lathe costs ...saving assembly time

Use laminated shims, stamped from *LAMINUM*, to position machine elements accurately. With a .126 inch shim, made up of .002 inch laminations, for example, you have a full 1/8th inch of adjustment **built into** your assembly. There is NO filing or precision machining or grinding.

FOR SPLIT BEARING of lathe headstock spindle. Even after peeling, shim is always uniform in gauge, with a hard, clean and smooth surface.

PLUS these advantages:

- All adjustments AT THE JOB.
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FOR THRUST BEARING adjustment of pump. Peelable shim is valuable for takeup of wear after service, reducing "down time" for maintenance.

Send today for our new data file with specifications, design factors and applications. Sample of ***LAMINUM*** included.

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Press capacity to 100 tons, 24 inches square, shallow draw. Special equipment and variety of dies can eliminate die-making for short runs. Wide stock of materials. Let us quote on your *difficult* jobs.

* ***LAMINUM*** (Reg. U. S. Pat. Off.) shims are solidly bonded units made up of .002 or .003 inch brass or steel laminations with a microscopic layer of metallic binder. Cut to your exact specifications.

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previous experience, special qualifications and capabilities. The foreman who treats his workers as "shop help" can't expect special consideration when he needs special help. It cannot be over-emphasized that the most profitable investment a foreman can make is to spend some time in discovering and developing the capabilities and special qualifications of his men. Without a doubt, the productive yield of present personnel could be increased to an appreciable extent if management could unleash all the power and ability locked in the hearts and minds of its employees.

Harry Kaufman
Philadelphia, Pa.

Al's idea is O.K. in this instance to go into the shop to solve his trouble in the example quoted about the forming die: The experience of a qualified tool & die maker is very often of great advantage. He may have come up against some die job elsewhere that gives him the kink to get the bug out of a job that often stumps the engieering department of a big plant or the brass hats in the smaller places.

Like the doctor of medicine who becomes more expert with experience in applying his knowledge to patients, the toolmakers likewise gain experience and increase in value to firm as they get around. This point has been sadly lost track of in many shops where the gray-heads of long experience have been replaced by younger, less-experienced men. I have seen engineering heads and lesser board-men become extremely jealous of these older, experienced men in trying to put out a job the tool maker knows more about than the actual designer.

My contention is that too many places neglect and fail to appreciate the experienced machinist, tool or die maker. Our own government is just as guilty of this neglect of our value. In war, we are wanted; and then when war is over we are allowed to drift again, and you never hear of a pension or aid for us under 65.

May I quote several instances where I saw Ed's idea fail and Al's plan to go to the shop tool maker meet with success and pay off big. In the one instance a costly machine was under construction that was a positive failure when trials began. Engineering brass was stumped. The executive heads called a meeting to decide on firing the engineering head. An Al came forward in this instance with the suggestion to call on a certain experienced tool maker.

Here's why BOTH

your press packings *and* your hydraulic oils should come from one source!*

First, packings should be impervious to the hydraulic oil medium used. Houghton makes both products . . . knows they are compatible.

Secondly, if the supplier's experience covers all elements of operation of the press, he can impartially advise users. Houghton has that knowledge.

And lastly, there is an advantage to the buyer in dealing with one source for hydraulic maintenance products . . . no divided responsibility.

So why not investigate Houghton's HYDRO-DRIVE Oil, fortified to provide oxidation stability, gum solvency, corrosion protection and film strength. And Houghton's hydraulic packings, including Vim Leather and Vix-Syn synthetic rubber — a complete line, skillfully engineered. They'll help you keep press rooms running at a minimum of down-time and maintenance expense.

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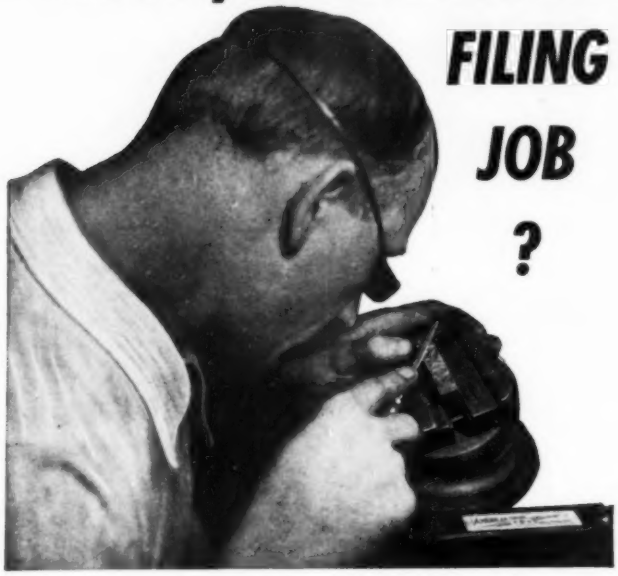

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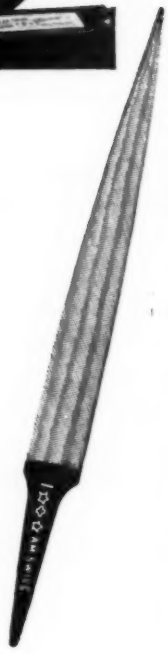

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His attitude was to condemn the whole machine and build a new one on lines somewhat similar to a job he had seen elsewhere. The heads were so impressed they ordered a new machine after the tool maker's ideas and it worked without trouble right off. That machine has now run 21 years. In the second instance, I saw a drawing operation on metal turn out badly. A representative of the steel company was sent in response to the firm's complaint on the metal.

Taken into the shop right up to the bench to inspect the dies, this representative spotted a die maker he had seen elsewhere on a similar job. He asked especially that the job be turned over to this man. The trouble was eliminated, the same steel used for forming in the first instance proved OK. When this more experienced tool maker was asked why he did not say he could handle the job and save all this time, etc., he just said, you never asked me and I did not butt in.

Henry Rasmussen
Niagara Falls, N. Y.

•

Excellent ideas sometimes come from very unexpected sources and there is no plausible reason that I can see why those that have merit should not be used regardless of their source, if they come honestly, and the donor is given due credit.

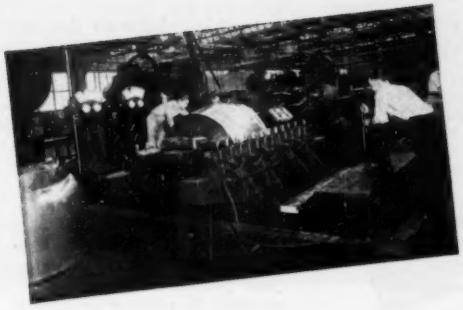
Those responsible for results should in no-wise shirk their duty or try to place responsibility on others, but on the other hand where helpful suggestions come from subordinates they should be accepted, appreciated, and due credit given.

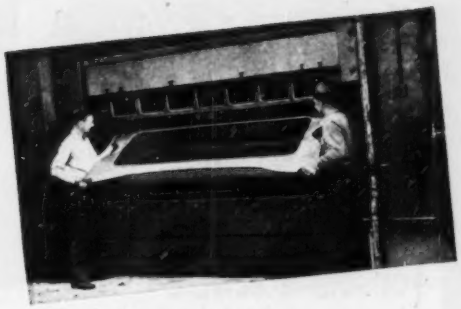
Early in the twentieth century, a young man with only about five years' experience was placed in charge of a machine shop where a large variety of work was done where the new foreman was confronted with many problems new to him. He was greatly helped by the older and more experienced workers whose advice was greatly appreciated and promptly acknowledged.

This shop happened to be in the same town as an engineering school.

The new foreman, not having had the advantage of an engineering education, was frequently confronted with problems that he could not solve however, during the time while while working in this shop as an all-around machinist he had done some work for the school and came to get acquainted with one of the professors.

As problems came up that were beyond the foremen's ability to solve he went to the various professors,





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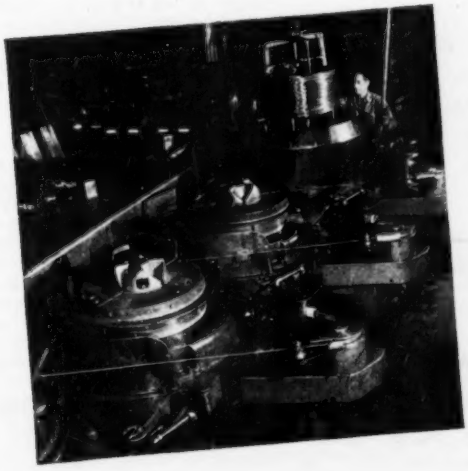

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If you're tired of wearing down pencil points figuring jobs, Speed Alloy Hot Rolled Alloy Steel Plates are the answer. Users are calling it "the most economical mold and die steel available." Bridges the gap between carbon and tool steels. Deep hardening properties (surface hardness in excess of 40 Rockwell C, core hardness up to 37 Rockwell C, depending upon section, are typical) result from the addition of chromium and molybdenum, permitting use where relatively high compressive strengths are required.

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most of whom he had never before known and stated very frankly his lack of knowledge on the problem at hand and asked if they would help him out, which they always did without any compensation other than words of thanks and appreciation. Although warning had been given him that it would be a foolish thing for him to go to those big fellows by whom he would probably be snubbed.

My experience leads me to advise going with an honest purpose to any one whom you think may help in your problems regardless of their standing in position or society.

Abel Blakeman
Watervliet, N. Y.

•

CAN ENGINEERS COME INTO THE SHOP?

This problem of Ed's is one that frequently exists in small shops. The engineers or draftsmen seem to delight in getting out into the shop and changing the method of producing items that they have partly thought through and put down on paper. Too frequently designs are completed without a good conception of what is required. The draftsman or design engineer does not do his job completely and when it goes to the shop things are lacking. Foremen sometimes can not help themselves and have to call for help from the engineers, thus opening the door for a steady flow of changes.

It is unfortunate for the engineering profession that such things exist. This practice results in the loss of respect for the engineers by the shop men. They are thought of as guys who know little but get big pay. The more the engineers make changes the less respect the shop has for their ability. It would be a lesson well learned if the engineers would stay out of the shop and do their work on the board or in the experimental labs before releasing products for production.

As a graduate engineer, I can certainly say that too many young fellows are tempted to go into the shop and get into the foreman's hair. This is not intentional, but frequently comes from poor training in college. The young engineer usually doesn't have shop training and he thinks he knows all the answers. If he would only realize how cheaply he sells himself to the worker, he would spend more time on his job doing it right and less time trying to correct it in the shop where the foreman is trying to get production.

No foreman should ever allow an engineer to overstep. He should see that the engineer always clears

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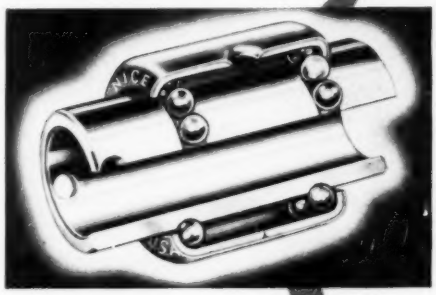

Economists tell us that supply now exceeds demand and only the *alert and efficient* will survive the "acid test" of the new Buyers Market.

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through him before talking to the men under his control. Never should a foreman let the engineer just take over the job, for this does two things. First, it divides authority and the foreman loses his grip on his men. Secondly, it hurts the engineer if he makes too many changes. In neither instance does it do the company any good.

Al's statement that the job is better might be right, but he is not involved and I belive if he were suffering from "engineer control" he would sing a different tune.

There is not any good way to have engineers and shop men work together unless a company has an established policy of development work which is supervised by an engineering staff. Under this plan, men are more or less borrowed from the foreman, then work under the direct orders from the engineer in charge of the project. This method of operation helps get better products and will give best ultimate results.

Charles D. Townsend
Centralia, Mo.

•

In reply to your request for ideas on the time-beaten scrap between men-on-the-job and "those blankety-blank pencil pushers," may I stick my neck out too?

True, some work comes out to the worker that is badly planned. Conditions change during the period between conception and execution of the idea that make the finished product seem incongruous to the worker. Many times the finished product shows little consideration for the accessibility of much-used locating and holding devices. But there is one more very important reason why work is often criticized, why theory and practice traditionally clash in the shop. You, Mr. Engineer, are to blame.

Some otherwise fine evening, come home, and with no advance notice or explanation, throw some vegetables on the table and announce you will have a New England boiled dinner. If you're lucky, and agile, you may not get cauliflower . . . ears!

The same applies in the shop. Take a rough draft of the idea out and have a chat with the man on the job. Even if he has no suggestions, and he just MIGHT have, you have given the man his feeling of importance. That is why an unannounced idea meets resistance. The worker unconsciously is getting his feel of importance that his ego demands. You, Mr. Engineer, by selling your idea, or at least letting the man in on it, can supply that feeling and reap its

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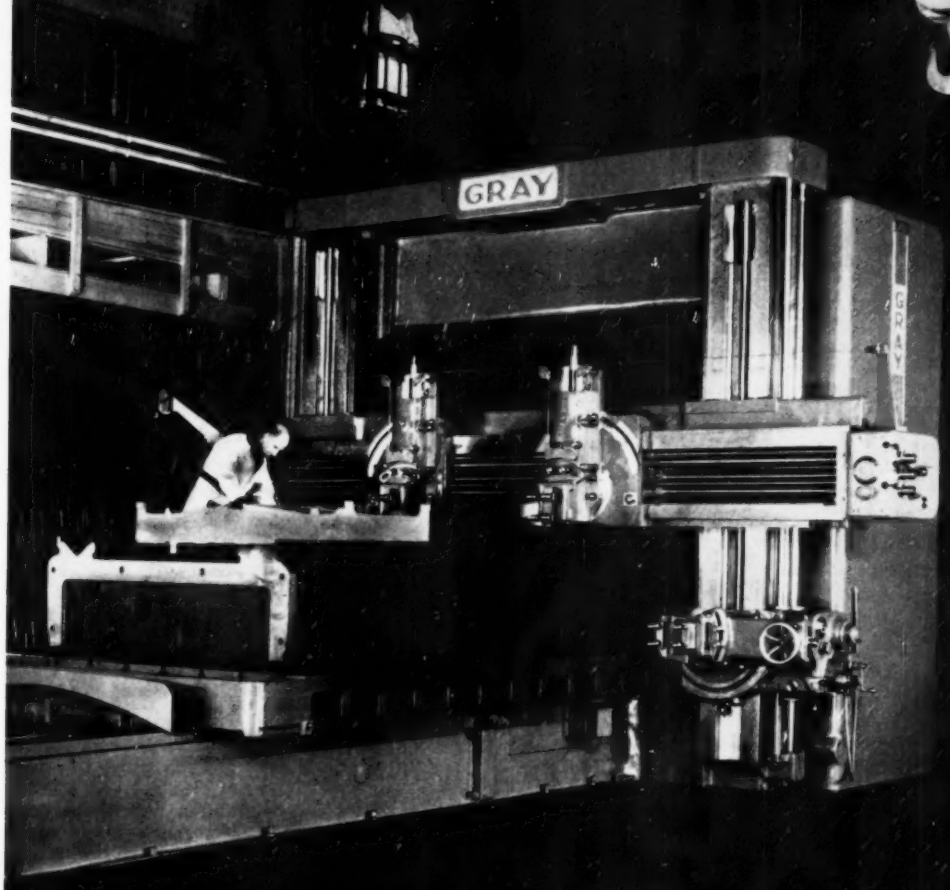

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Donald E. Wood
Allegan, Mich.

TO THE EDITOR

Sir: Where is the old-time machinist's attitude in these postwar days? It seems to me that when I was learning my trade a machine was treated with reverence; tools were handled with care and respect, and the guiding advice of an old-timer was highly appreciated.

With the end of the war, thousands of ex-GI trainees are learning trades in shops all over the country. We are training quite a few in our plant; at least six of these I have "broken in" on planer operation.

After a few days with me they are assigned to operate the same machine on another shift. Instantly, every one of them becomes a "chip-hog"—just can't wait to rip out a heavy roughing cut—make the machine groan. My studs get stripped or broken; tools are ruined, and the machine is strained. When I start work, I feel like a helper. Chip-filled T-slots must be cleaned out to find T-nuts left there from former jobs. Tools need resharpening; blocks, parallels, pinch-bars, wrenches, and gages are scattered all over the shop. They never lubricate the machine, but instead leave all this climbing to me.

I'm an old man, and I can't take my skill with me. I'm proud of these kids and the job they did in the war. I'd like to know that they will carry on the trade with the same old tradition. The future of America depends on skilled mechanics, and every old-timer should be willing to add his experience to strengthen that future.

I've tried to be fair, cordial, and helpful. Anything that I can offer is given gladly. I don't think that our trainees intend to be sloppy and careless, they just don't know any better. If I suggest that the boss speak to them, he laughs at me! When I say anything, I'm a crank! What can be done about it?

V. H. J.

Suverkrop and Gage Blocks

Re "Suverkrop and Gage Blocks" (*A.M.*, May 19), I can remember the 1909 article as well as the 1918 report on the patent issue. I kept these articles many years in my

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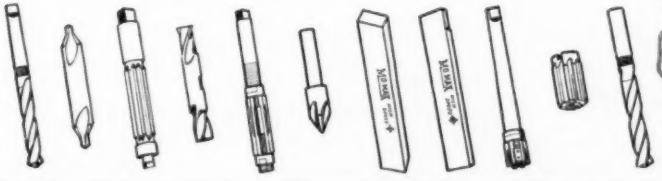

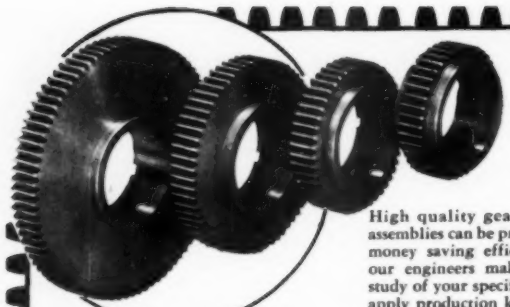

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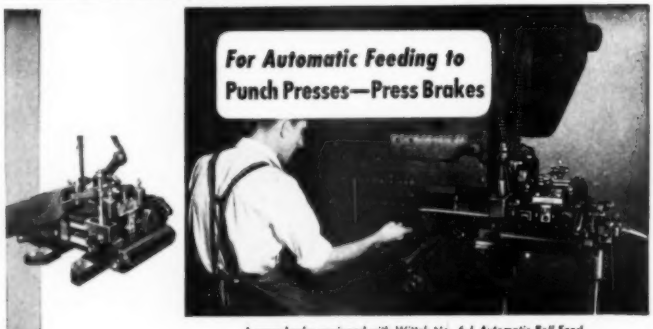

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Automatic ROLL FEEDS AND REEL STANDS

AMERICAN MACHINIST files, and actually did not discard the lot until 1935.

I filed them because I knew and worked with a Swede, Helding D. Emberg, who made a set of square or "Hoke" blocks in Sweden in the late 1880's and brought them to the U.S.A. in the 1890's and worked in New England with them at his trade as tool and diemaker in several watch, bicycle and sewing machine shops.

As I remember, he met with a great deal of ridicule wherever he used them. Only one shop showed any great interest in them and not one wanted to undergo the cost of making its own.

My recollection of this set of square test blocks was that they varied a few thousandths on a side. All three dimensions were lapped to mirror finish. Any sides would wring together. I have seen him wring the entire group together and they held. The entire group were in decimal sizes under 1 in. He said he made them for use in an arms plant in Sweden. He carried a small quartz optical flat with him and would test a block on it, demonstrating the value of light in proving he had no low corners on his surfaces. What I fail to remember is if he ever mentioned the light values in millionths as we know it today.

Emberg said his blocks were hardened and seasoned by repeated natural winter freezing, then heating over long periods of time. He ground them and laid them away, then in time lapped them.

His laps were small round plates proven with working down three plates rigged with an eccentric motion in a perfectly trammeled drill-press. Then blocks were hand-finished.

I am inclined to believe Emberg was one of the first to use these blocks in this country. Some men in the East may remember him. I worked with him after the turn of the century in the Community Silver tool and die shop. He was quite proud of his blocks which he kept on oiled felt in a tin box.

Emberg was one of the finest hardeners I ever saw. He could take ordinary carbon steel, cut it into almost any kind of an intricate shape and have it come out in hardening with less distortion than any man I ever knew. He did not need non-changing oil-hardening steel in his day. When he died he took all his knowledge with him, as he would never let anyone know his secret.

Henry Rasmussen
Niagara Falls, N. Y.

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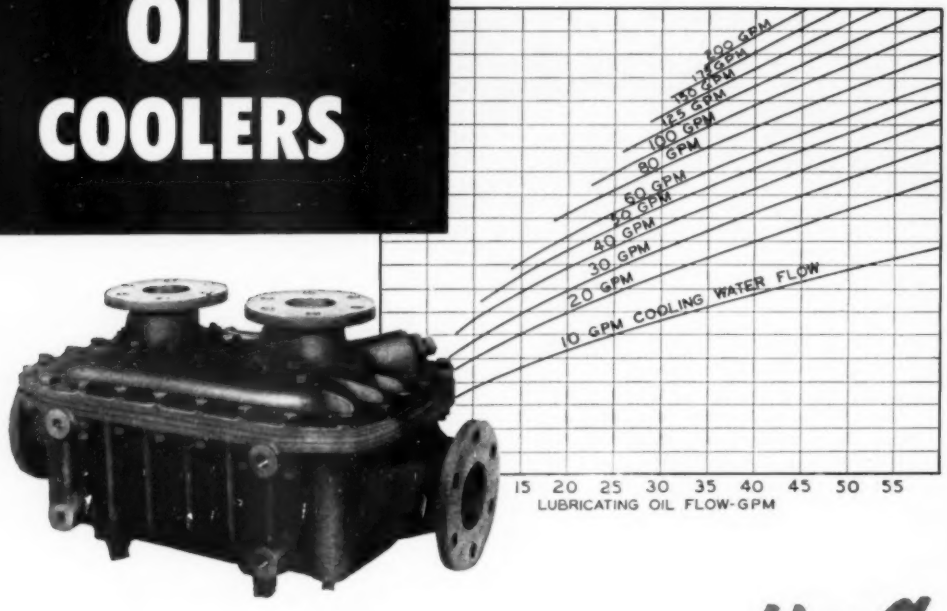

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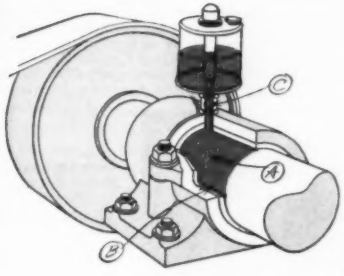

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B. Contains extreme pressure stringiness and oiliness additives . . . tough lubricating film remains intact in wide range of temperature conditions.

C. Small quantity provides adequate lubrication.

Calol Vistac Oil may be applied by forced feed, gravity, and sight-feed cup lubricators; the lighter grades by wick- and ring-oilers.

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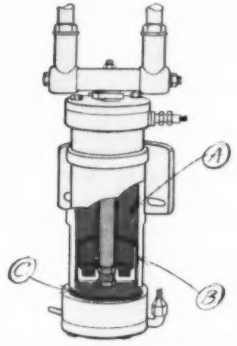

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B. High metal-wetting ability and corrosion inhibitor prevents rusting and pitting.

C. Separates readily from water or other contaminants — dirty oil may be reclaimed easily.

In turbines, the corrosion inhibitor in Calol OC Turbine Oil assures protection against rusting even during the critical initial operating period.

For additional information and the name of your nearest Distributor, write

STANDARD OIL COMPANY OF CALIFORNIA
225 Bush Street, San Francisco 20, California

The California Oil Company
Barber, New Jersey

The California Company
17th and Stout Streets, Denver 1, Colo.

Standard Oil Company of Texas
El Paso, Texas

CALOL

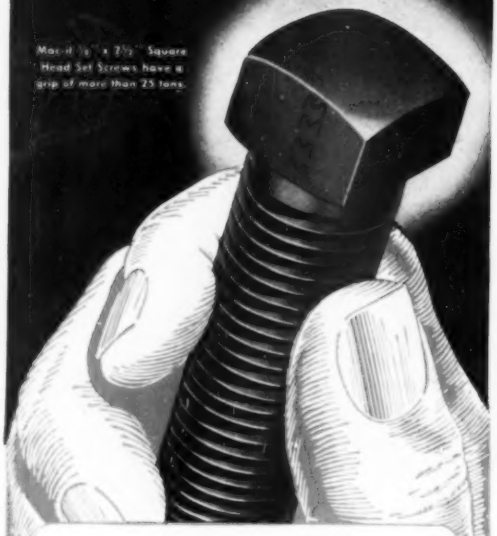
Trademark Reg.
U.S. Pat. Office

IT'S A

Mac-it ®

PRONOUNCED "MACK-IT"

Mac-it ½" x 2½" Square Head Set Screws have a grip of more than 25 tons.



BETTER, FASTER SERVICE WITH THIS *COMPLETE* MAC-IT LINE!

Because many standard types of Mac-its are stocked throughout the country for quick delivery, and because specials can be engineered to your own specifications, you'll find it pays to investigate Mac-its *first*.

Mac-it's 35 years' experience in the manufacture of heat-treated, alloy steel screws is your assurance of precision, uniformity and strength. Sold through leading industrial distributors from coast to coast and in Canada. Write for new catalog today!

Other Mac-it products include:

- Hollow Lock Screws
- Socket Head Cap Screws
- Hollow Set Screws
- Stripper Bolts
- Hollow Pipe Plugs
- Socket Screw Keys
- Hexagon Head Cap Screws
- . . . and many others

Marketed Nationally Since 1913 by

STRONG, CARLISLE & HAMMOND COMPANY

Cleveland 13, Ohio

Manufactured by MAC-IT PARTS COMPANY, Lancaster, Pa.

$1,500 inventory abolished —at a cost of $4.46!

With more than 700 vacuum tubes needed by industry, a tube distributor would find profits consumed by 100% inventories. But by ordering tubes as needed via Air Express, he holds stocks to 25%. Example: Orders $1,500 tube at 9 A.M. from supplier 900 miles away. Delivered to customer 6 P.M. same day. 16 lbs.: cost, $4.46.

Remember, $4.46 *included* speedy pick-up and delivery service, too. *More* protection, because you get a receipt for every shipment. Air Express is *world's fastest* shipping service.

Your Air Express shipments go by the Scheduled Airlines direct to 1300 airport cities; fastest air-rail for 22,000 off-airline offices. Shipments *keep moving* with 'round-the-clock service.

Facts on low Air Express rates

19 lbs. of machine parts goes 600 miles for $3.54.
9-lb. carton of new styles goes 1400 miles for $3.99.
(Every kind of business finds Air Express pays.)

Only Air Express gives you all these advantages: Special pick-up and delivery at no *extra cost*. *You get a receipt for every shipment* and delivery is proved by signature of consignee. One-carrier responsibility. Assured protection, too—valuation coverage up to $50 without extra charge. Practically no limitation on size or weight. For fast shipping action, phone Air Express Division, Railway Express Agency. And specify "Air Express delivery" on orders.

SPECIFY AIR EXPRESS

IT'S THERE FIRST

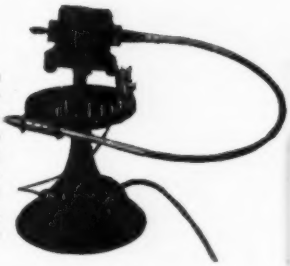
Rates include pick-up and delivery door to door in all principal towns and cities

AIR EXPRESS, A SERVICE OF RAILWAY EXPRESS AGENCY AND THE SCHEDULED AIRLINES OF THE U.S.

HERE'S HELP FROM haskins

IMPROVE PRODUCT QUALITY, CUT PRODUCTION COSTS!

Yes, here's real help from the leading manufacturer of flexible shaft equipment . . . HASKINS! It's *help* in the form of versatile tools that assure high quality work, stand up under hard, continuous service, and free labor for more productive work. Haskins Flexible Shaft Machines speedily and efficiently perform grinding, sanding, filing, wire brushing, buffing and polishing for die, mold, and patternmaking, stainless steel and general fabricating. And remember, with flexible shaft tools, the operator handles only the lightweight handpiece—the heavy motor is conveniently located 6 feet away. Operator works faster, with less fatigue. Haskins makes a *complete line*—from lightweight, direct-drive machines, to heavy-duty, multi-speed units . . . all designed to help you speed production and lower costs.



HASKINS VB-2 high speed grinder develops up to 18,000 r.p.m. free speed . . . makes cutting wheels and tools last longer. Recommended for general light production work. Suspended or bench mounted.

HASKINS HS-4 is a pedestal mounted, portable machine recommended for general die shop work . . . has a ½ h.p. air jacket motor, and six-speed, Timken-bearing countershaft that develops up to 7800 r.p.m.

HASKINS RA-5 is recommended for lacquer polishing, rubbing and sanding operations where a portable unit is desired. Heavy-duty ½ h.p. motor, direct drive with speeds to 3425 r.p.m.—pedestal mounted.

HASKINS SPH-6 for stainless steel grinding, sanding, buffing, etc. Has a 1 h.p. motor; four-speed Timken bearing countershaft; speeds to 3400 r.p.m. Mounted on pedestal at bench height.

HASKINS HS-7 is mounted on a three-wheel, heavy-duty truck. Full 1 h.p. motor, four-speed countershaft develops up to 3100 r.p.m. Here's portable equipment recommended for heavy grinding, sanding, wire brushing and polishing operations.

HASKINS haskins

FLEXIBLE SHAFT EQUIPMENT

R. G. HASKINS CO.
2643 West Harrison St.
Chicago 12, Illinois

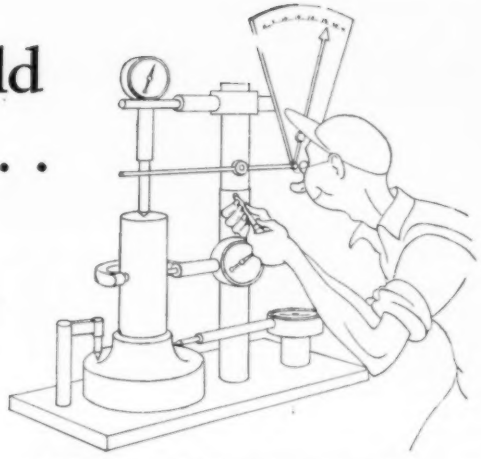
Please send me complete information on the following:

☐ HASKINS VB-2 ☐ HASKINS HS-4 ☐ HASKINS RA-5
☐ HASKINS SPH-6 ☐ HASKINS HS-7

Name .....
Firm Name .....
Address .....
City ..... **Zone** ..... **State** .....

Sure you can build your own gage . . .

BUT *can you afford it?*



You can't tell the true cost of a gage until you put it on the job. We see it all the time . . . thousands of dollars wasted in machine time, man-hours, and scrap because inspection gages don't live up to expectations. Old style gages, improperly designed special gages, or inspection tools of the wrong type may be imposing a heavy tax on your profits.

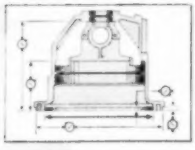
Why put up with this when you can obtain production-proved special gages built by *Gaging Specialists!* Federal Gages have money-saving features:

precision that puts the finger on faulty work
speed that cuts down inspection time
design that positively checks the exact dimension in question
convenience that eliminates inspector fatigue
visibility that makes for easier, surer gaging
size readings that are essential to quality control

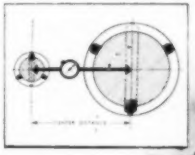
The design of each Federal Gage—manual, semi-automatic, or automatic—is based on years of experience in engineering and manufacturing gages for almost every conceivable dimension.

Whether mechanical, air, or electronic, a Federal Gage is built to deliver real profits in speed and economy. Let us recommend the right Gage for your needs — our nearest representative will be glad to discuss the details of your problem. Or send blueprints and specifications to Federal Products Corporation, G1102 Eddy Street, Providence 1, R. I.

Here's how FEDERAL solved a couple of inspection problems



◀ A leading vacuum cleaner manufacturer inspects 8 dimensions of motor housings on this combination Air and Dial Indicator Gage. In one time-saving operation, four depths and four diameters are checked simply by positioning the workpiece and taking the dimensional readings.



This gage puts ▶ new speed into measuring center distances. Just locate the two spring-loaded mandrels in the holes and the Dial Indicator shows the actual center distance at a glance.

FEDERAL

PRECISION MEASURING INSTRUMENTS

DIAL INDICATORS • INDICATING GAGES • SPECIAL GAGES • ELECTRONIC AND AUTOMATIC SORTING GAGES • AIR GAGES

Baker 4 Station Automatic Transfer Machine

Increases Production— Reduces Handling

For End Operations on Axle Housings

1 Flexibility provided for handling housings from 60" to 92" in length with bore diameters ranging from 1½" to 2 7/16".

2 Spindle ends carrying Coredrills at first station piloted through live bushings. Total depth of coredrilling divided into four passes.

3 Parts automatically clamped at each station by hydraulic pressure which turns screw that actuates jaws. Hydraulic pressure always on, assuring positive clamp at all times.

4 Housings raised on index rails and indexed to next station hydraulically. Automatic unloading.

BAKER

BAKER BROTHERS, Inc., Toledo, Ohio

Drilling, Tapping, Keyseating and Contour Grinding Machines

HENDEY
No. 2
GENERAL
PURPOSE
LATHE

We've put a "BRAIN" in the famous Cone Head

The Hendey No. 2 General Purpose Lathe is a worthy, "brainy" successor to the world famous Hendey Cone Head Lathe. This new lathe has all the facility of the cone head, but has a single lever for instant belt shifting. It has eight speeds, but no expensive geared head. There is an independent motor in the base, plus a unique feature which eliminates belt pull on the spindle. There are 48 thread and feed changes, and graduations permit spindle indexing for cutting multiple threads. The bed ways, both carriage and tailstock, are hardened and precision ground. The "brain" in the No. 2 is your assurance of maximum profits with minimum operator fatigue—the Hendey name is your assurance of highest precision. Write today for details and catalog.

PRINCIPAL DIMENSIONS

Rated size	14"
Swing over ways	16 7/16"
Swing over cross slide	10 1/4"
Spindle bearings—Preloaded super-precision roller bearings	
Spindle nose	L-1 taper nose
Hole through spindle	1 1/2"
Range of spindle speeds	30 to 1142 R.P.M.
Carriage bearings on ways	21 1/2"
Width and length of cross slide	7"
Compound rest travel	4"
No. of thread and feed changes	48
Range of thread cutting	1 1/2 to 92

THE *hendey* MACHINE COMPANY

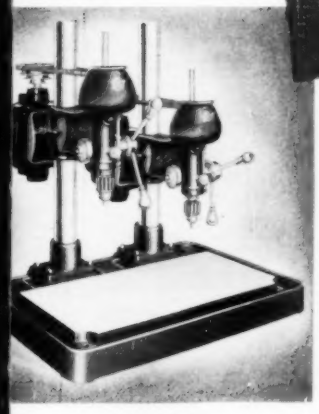
MAIN OFFICE & PLANT: TORRINGTON, CONN.

BRANCH OFFICES: New York, Chicago, Boston, Detroit, Rochester, Los Angeles, San Francisco

REPRESENTATIVES: Philadelphia, Cleveland, Pittsburgh

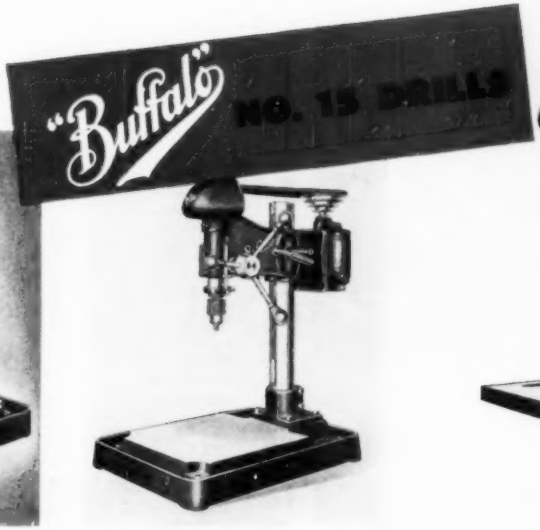
hendey

Simple, Rugged Design
TO CUT YOUR COSTS PER HOLE!



"TWINS"

Two setups—two operations at once on this sturdy 2-spindle bench model. Available in up to 4 spindles.



NO. 15-M DRILL

An easy-to-handle heavy-duty manufacturing drill available in 1, 2, or 3 or 4 spindle units. Ample space for work pieces.

You can also have the No. 15 in floor models like the above—showing the wide range to fit YOUR OPERATIONS.

● WHERE you have a lot of drilling up to ½" to be done in a hurry—and done accurately—your lowest cost way is with No. 15 Drills! Their simple design means simple operation and setup adjustment. WORK 'EM DAY AND NIGHT—they're built sturdily and rigidly for years of punishment.

WRITE FOR BULLETIN 2963-D—see the many models ready to cut costs in YOUR production drilling.

"Buffalo" MACHINE TOOLS

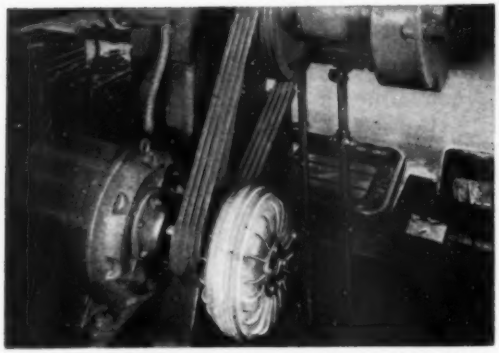
BUFFALO FORGE COMPANY

509 BROADWAY BUFFALO, NEW YORK

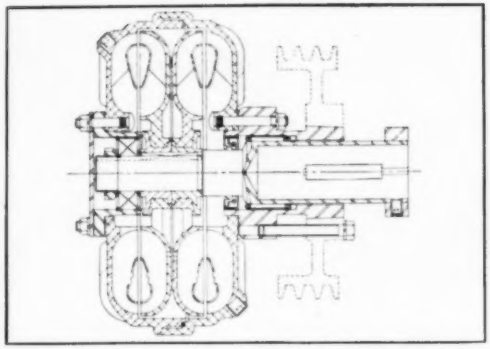
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING PUNCHING SHEARING CUTTING BENDING

Torrington Needle Bearings Save Space and Give Dependable Service in Twin Disc Hydro-Sheave

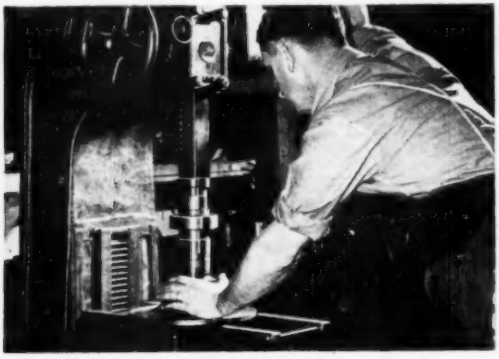


The Twin Disc Hydro-Sheave Drive, made by Twin Disc Clutch Company, permits smooth acceleration and prevents stalling of electric motors and internal combustion engines. Efficient power transmission is secured with compact Torrington Needle Bearings.



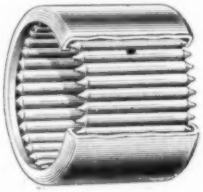
Cross-section shows location of the Needle Bearing under the sheave. The compactness of this bearing, with its small diameter rollers and thin outer race, makes it ideal for this application. Its oil reserve capacity eliminates need for pressure lubrication.

The full complement of precision rollers, operating on a hardened and ground shaft, provides tremendous load capacity. This feature, combined with the low coefficient of friction, assures reliable operation and long, trouble-free service life.



Needle Bearings are easily installed with a simple arbor press operation. The bearing takes a firm press fit, and therefore requires no retaining devices. Thus, to the advantages of compactness and efficient operation are added speed and economy of assembly.

Many machines can be made lighter, sturdier, more compact and more efficient with Torrington Needle Bearings. Our engineers will be glad to help you adapt these high capacity bearings to your equipment. Write us today. THE TORRINGTON COMPANY, Torrington, Conn., or South Bend 21, Ind. District offices and distributors in principal cities of United States and Canada.



TORRINGTON *NEEDLE* **BEARINGS**

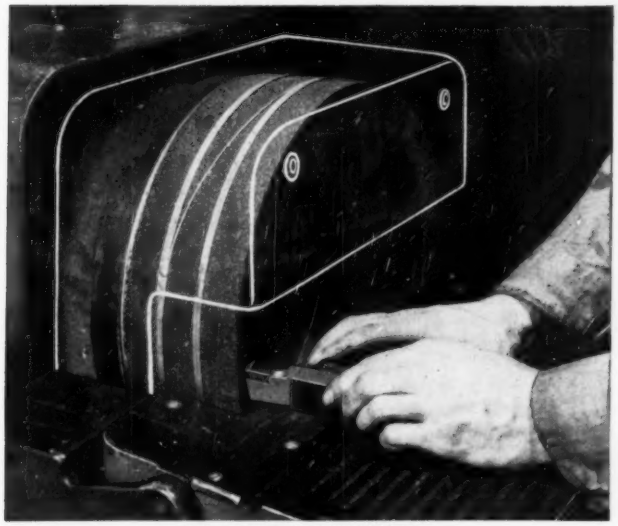
Needle • Spherical Roller • Tapered Roller

Straight Roller • Ball • Needle Rollers

BUXITE

GRINDING WHEELS FOR CARBIDE TOOLS

LIGHTER FEED... COOLER CUTTING



THE BUXITE PROCESS

(Formerly Controlled by The Bridgeport Safety Emery Wheel Co., Inc.)

The Buxite Process is a revolutionary method of coating **each individual grain** of Buxite wheels with a microscopically thin shell of carbon in an isotropic vitrescent form. Each shell permits its grain of abrasive to turn, exposing every cutting surface before it is worn away. Each succeeding layer of grains are contained in their individual carbon shells, assuring constant grinding action during the life of the wheel.

REPRESENTATIVES NOTE: There are a few desirable territories available to well qualified representatives. If you are interested, write us, giving full particulars of your operation and qualifications.

Buxite grinding wheels perform better and actually cut faster with light pressure. This means that carbides and other superhard steels can be ground with less heat being generated . . . which prevents checking and cracking, lengthening the life of the tools.

GRIND CARBIDE TOOLS AT 75% TO 85% LESS COST

Not only do Buxite wheels increase carbide tool life, but they give a cleaner grind and better finish. Buxite wheels do not "load" when grinding sintered tools, eliminating frequent stops for dressing, and the hard-shelled grains makes the life of each Buxite wheel 4 to 6 times that of ordinary wheels.

REDUCE DIAMOND WHEEL CONSUMPTION

The lighter cuts and cooler grinding action of Buxite grinding wheels results in excellent finish on Tungsten Carbide and other types of superhard alloys. Buxite wheels always reduce and frequently eliminate the need for diamond wheel grinding on this type of tool. This saving in diamond wheel consumption and costs is an important reason so many manufacturers and metal working shops have standardized on Buxite wheels for their tough grinding operations.

ADDITIONAL ADVANTAGES OF BUXITE WHEELS

Every feature of Buxite wheels contributes to faster production and lower piece cost on grinding operations involving super-hard tool steels. Faster, cooler cutting action, longer tool life, longer wheel life and reduction or elimination of diamond wheel consumption result in greatly lowered costs. If our representative has not called recently, write direct to us for additional information and money-saving facts.

MANSCO GRINDING WHEEL CO.

2164 EAST 36TH STREET — CLEVELAND 15, OHIO

Exclusive Suppliers of BUXITE Grinding Wheels

Where do we go from here?

NOW as never before, America stands at a cross-roads. One road is the way of easy promises by which we hope to arrive in the Never-never land of abundance for all and hardship for none.

The other way looks very much like the road we have traveled--the way that built America into the richest, strongest, most envied nation of all time. It is the road built by enterprise and resourcefulness and hard work--and thrift.

As a community leader it is your responsibility to help America choose the road we are to follow.

The Youngstown Sheet and Tube Company

General Offices--Youngstown 1, Ohio
Export Offices--500 Fifth Avenue, New York
MANUFACTURERS OF CARBON, ALLOY AND YOLOY STEELS

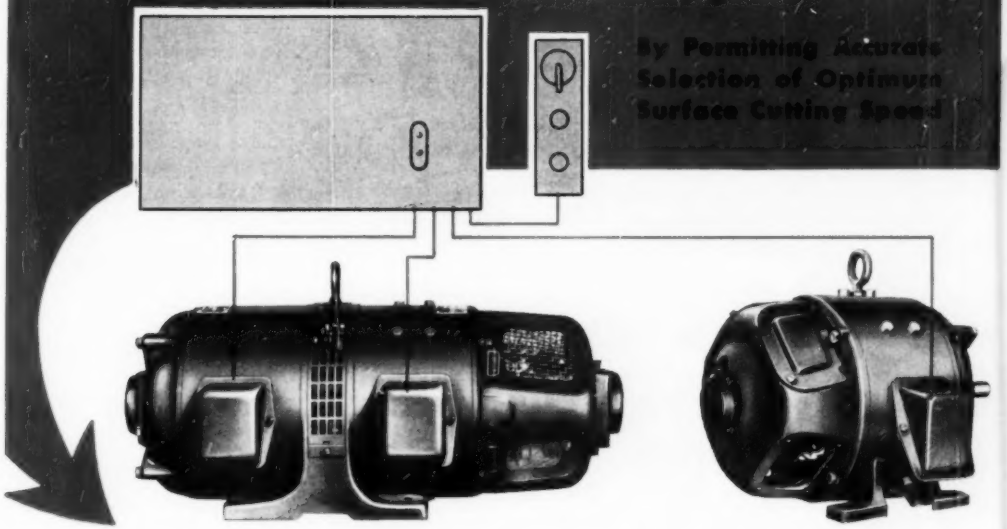
ELECTROLYTIC TIN PLATE - COKE TIN PLATE - WIRE - COLD FINISHED CARBON AND ALLOY BARS - PIPE AND TUBULAR PRODUCTS - CONDUIT - RODS - SHEETS - PLATES - BARS - RAILROAD TRACK SPIKES.

Century SELECTIVE SPEED Drive

For Operation From Alternating Current

Adds These Time and Labor-Saving Features to Your Metal-Cutting Operations —

By Permitting Accurate Selection of Optimum Surface Cutting Speed



- **Higher Production Rate**—Optimum cutting speeds provide best tool temperatures for high production
- **Less "Down Time"**—less tool grinding
- **Greater Accuracy** because of less heating of tool and work piece
- **Better Machine Finish** with more efficient cutting speed
- **Adaptable to Automatic Multiple Surface Cutting Speeds**

Century SELECTIVE SPEED Drives provide a wide range of stable speeds with fine steps of control. Eight to 1 speed ratio is standard, as much as 32 to 1 is available.

When required, these additional features are available: JOGGING — DYNAMIC BRAKING — REVERSING DIRECTION OF ROTATION — PRE-SET SPEED CONTROL.

Century manufactures a complete line of alternating and direct current motors and generators in the popular types from 1/6 to 400 horsepower. A line of gearhead motors is also available.

Call a Century motor specialist to discuss your motor drive problems. Write for literature.

Popular types and standard ratings are generally available from factory and branch office stocks.

-635

Century C MOTORS

CENTURY ELECTRIC COMPANY · 1806 Pine St., St. Louis 3, Missouri

Offices and Stock Points in Principal Cities

Facilities you can use *Profitably in Buying* Medium *and* Small Castings

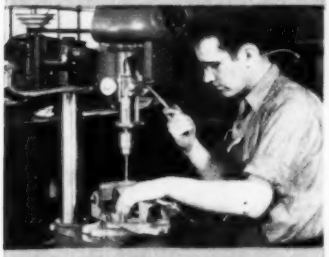
NE is the well known and long established symbol for quality carbon and alloy steel castings and gears used by industry. Diversified facilities at National Erie Corporation also provide a wide range of medium and small steel castings produced on squeezer and roll-over moulding machines . . . Our Rotoblast equipment illustrated here facilitates economical, speedy cleaning of the wide diversity of small and medium cast parts which we produce for a multitude of light industrial machines. National Erie engineers, metallurgists and craftsmen control every operation from raw materials to finished product within our own plant. We can serve you as we are serving hundreds of others with these complete and diversified facilities. Bulletin No. 7 fully describes our capabilities. Write for it.

NATIONAL ERIE CORPORATION

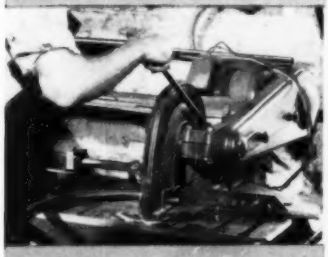
ERIE, PENNSYLVANIA • U. S. A.

Delta's line of band saws includes Delta 14" Metal-Cutting Band Saw, shown in use here, and the new Delta 20" Band Saw for cutting wood, plastics, and soft metals such as brass, copper, and aluminum.

Delta's line of abrasive finishing machines includes the Delta Abrasive Belt Finishing Machine used above, the Delta Abrasive Disk Finishing Machine, and the new Delta Belt Grinding, Polishing, and Deburring Machine.



Delta's line of drill presses include 14" and 17" single- and multiple-spindle, bench and floor models, with manual or power feed. Also included are Delta Super-Hi* Drill Presses, for small-hole work from .025" to ½" diam.



Delta Cut-Off Machines are available in a non-ferrous model and an abrasive model that is also adaptable for cutting wood.

Delta's line of grinders includes this Delta Toolmaker* Surface Grinder, as well as the Delta Toolmaker Chip-Breaker Grinder, Delta Toolmaker Tool and Cutter Grinder, Delta Carbide Tool Grinder, and Delta Grinder with Twin-Lite* Safety Shields.

Here's how DELTA-MILWAUKEE® Machine Tools help you *maintain volume and quality — with big savings*

There are many ways you can use low-cost Delta-Milwaukee Machine Tools to cut your operating costs, without penalizing output and quality: Here are three . . .

1. You can build high-production, special-purpose machines using standard Delta components—without the delay and heavy capital outlay ordinarily involved in buying inflexible special machines of limited usefulness. Machines using Delta components are readily convertible when change overs are required.
2. You can modernize many obsolete machines, by replacing worn-out assemblies with standard Delta components—thus saving the expense of new machines.
3. You can utilize the portability and compactness of Delta-Milwaukee machines to revise or supplement your present production methods, for more efficient operation.

DELTA MILWAUKEE®

Delta's savings in cost — and in weight and space — are not obtained at the expense of quality. They result from advanced design and from quantity production of standard models.

Take advantage of the many uses of Delta-Milwaukee machines, to cut your investment risk in tools and retain more liquid working capital. Inspect them at your nearby Delta distributor. Ask him about buying on easy time payments.

DELTA MANUFACTURING DIVISION
ROCKWELL MANUFACTURING COMPANY
MILWAUKEE 1, WISCONSIN

Look for the name of your Delta Distributor under "Tools" in the classified section of your telephone directory.

Send coupon for catalog A48.

*Trade Mark Reg. U. S. Pat. Off.

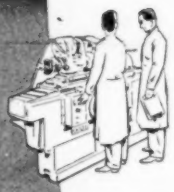
TEAR OUT COUPON AND MAIL TODAY!

DELTA MANUFACTURING DIVISION
608G E. Vienna Ave., Milwaukee 1, Wis.

Send me free copy of catalog A48.

Name.....
Title.....
Company.....
Address.....
City.....(.....) State.....

Cut "set-up" time
Slash toolroom grinding costs

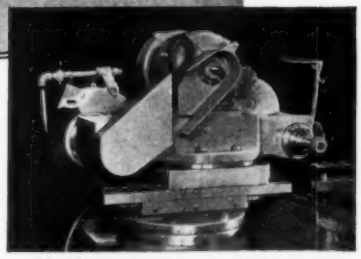


with the *New* RIVETT 1024 TOOLROOM GRINDER

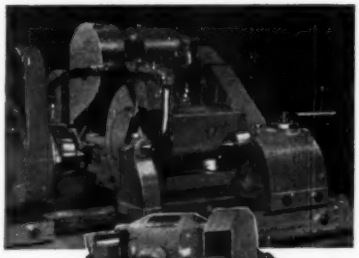
At long last! — a toolroom grinder that *does* something about "set-up" costs, far and away the most expensive item in toolroom and small lot grinding. On internal and external grinding work on straight, taper, two-angle, face and shoulder surfaces, Rivett 1024 has these *new* features to help you cut "set-up" time drastically:

1. **Double-end wheelhead** — Exclusive! Two spindles on swiveling workhead make possible rapid changes to internal or to external work. 2. **Hydraulic table reciprocation** — infinitely adjustable for speed and length of travel. 3. **Graduated swivel table and sine bar on workhead** — assure accurately measured tapers and angles. 4. **Optional work holding methods** — uses collets, step chucks, jaw chucks, plates, fixtures or "on-centers." 5. **Adjustable spindle speed** — internal from 6,000 to 35,000 r.p.m.; external 1800 or 2100 r.p.m.

And that's not all — the Rivett 1024 Grinder has been specially designed to extend the *range* of your grinding operations . . . double slides and swivels on cross slide increase possible "set-ups" *including double angles at one grind* . . . external wheel can be mounted on either end of spindle to permit face and shoulder grinding using periphery of wheel . . . positive table stop with micrometer adjustment positions work.



New! **Double-end wheelhead carries both internal and external spindles . . . swivels 180° to position *either* spindle. *Found only on the new Rivett 1024!***



CUT COSTS ON TOOLROOM GRINDING

Bulletin 1024 tells the whole story in pictures and helpful technical information. Write for your copy today.

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Polish contours with belts?

Yes!

Typical contours finished by Behr-Manning belts

ADVANTAGES of this new abrasive belt method:

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Fewer polishing operations—
No wheel marks—
Longer equipment life—
No rework from poor finishes—
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No wild grain troubles—
Belt finishes buff up easier—
Faster production all around.

All this and CONTOURS too!

BEHR-MANNING APPLICATION ENGINEERS

have developed a method using coated abrasive belts which on the most difficult of contours produces uniformly superior finishes—free of wheel marks—free of blending marks—and does it quicker and easier. The "know-how" on this new profitable method is yours for the asking, with no obligation. Simply fill out the coupon below and mail it to us.

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I want to know more about contour polishing with abrasive belts.

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With labor and material costs at their present levels, it takes some mighty careful management to hold your *unit costs* to the tolerances required for competitive selling.

One good way to do this is to install new and more efficient machine tools . . . such as the completely redesigned ROCKFORD 14" Geared-Head Economy Lathe. It is fast and easy to operate and is ruggedly built for long service. Though medium in price, it provides accurate work . . . for the tool room, maintenance shop, or production line. Design features include large, accurate lead screw uninterrupted by keyways—an independent feed shaft with interlocking safety clutch —thread cutting dial—and drop-lever feed engagement.

We'll be glad to send you full particulars. Write for Bulletin 462.

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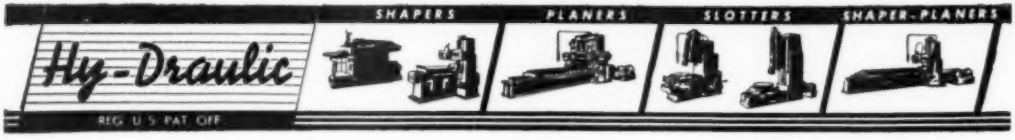

it DIGS...it LOADS at tremendous savings

the DEMPSTER DIGGSTER

TRADE MARK REG

Whether you need it for excavation work or loading from stockpiles or both, you need the new low production cost of the Dempster-Diggster. Here is the only small shovel that works on a hydraulic, simultaneous or independent crowd and hoist action and completely eliminates tractive effort in loading with wheels. Its variable crowd action at any dipper position means the Dempster-Diggster can dig lower . . . 15 inches below grade. Exclusive hoisting action means it can dig higher . . . digs out a 15 ft. bank. It's the only small shovel featuring such speed and mobility . . . travels at truck speeds on the road . . . gets in tight places on big jobs, freeing large shovels for heavier work. Ideal for the small and medium size excavation jobs yet powerful and fast enough for big jobs.

Stockpiling or loading work is easy for the DEMPSTER-DIGGSTER. Its speed . . . its 15 ft. turning radius . . . its extraordinary dumping reach help the Dempster-Diggster complete the average loading job in an amazingly short time. Dempster-Diggster buckets are easily interchangeable and are availab'e in three sizes. 1 cu. yd. (heaped) with hardened steel teeth for digging . . . 1½ and 2 cu. yd. for loading and stockpiling work. Power is supplied by a heavy duty gasoline or diesel engine. Hoisting, crowding, steering and braking are all 100% hydraulic. For complete information, write today for Folder Number 8154.

Large photo above shows Dempster-Diggster loading crushed stone. Note how independent crowd and hoist action permits bucket to follow the slope of the material. At right, top: Digging out high bank. Right, center: Closeup of 1 cu. yd. (heaped) digging bucket. Right, bottom: Dumping crushed stone into truck.

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Please send me, without cost or obligation, a copy of Bulletin 449, "Farrel Speed Reducers".

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Open view of enclosure for surface mounting

Closed view of enclosure for surface mounting

Bulletin 600 Switch with waterproof enclosure

Bulletin 600 Switch fits any standard switch box

Here is a small, manually operated starter that will satisfy the latest ruling of the National Electrical Code . . . which requires overload protection for a great many fractional horsepower motor applications. The Bulletin 600 Starting Switch is built in the single- and double-pole construction, and is rated one horsepower and less. Its dependable thermal breaker trips the switch under a sustained overload, protecting the motor against burn-out. When the overload is cleared, the breaker is easily reset with the switch lever. However, the switch cannot be held closed so long as the overload condition remains.

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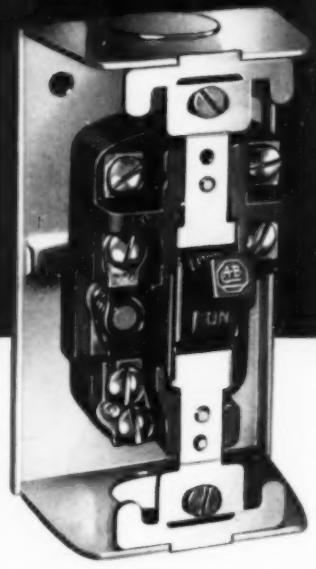
SAVE 30% to 40% of INSTALLATION TIME

on Starters for Small Motors (1 hp or less)



BULLETIN 600

Manual Starting Switches with Overload Protection

•

No Need to Remove Starter from Enclosure

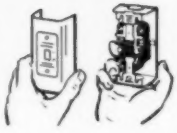
Installation of the Bulletin 600 Starting Switch is so simple that contractors have saved as much as ten minutes in installation time. In addition, they have found the switch exceptionally reliable.

•

GENEROUS WIRING SPACE
ATTRACTIVE APPEARANCE
SIMPLE DESIGN

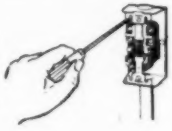
STEP 1—REMOVE COVER

Simply remove two screws on the front of the Bulletin 600 Starting Switch and the metal cover slips off, exposing the front and two sides of the switch.



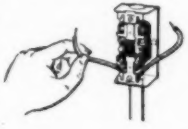
STEP 2—MOUNT UNIT

Mount the switch on the wall with two screws. Conduit openings on top, bottom, and back permit easy connection. No need to remove the starter from the box.



STEP 3—PULL IN WIRES AND CONNECT

Because the compact mechanism allows ample space, wires can be pulled into the box and connected to the terminals without removing the switch from the enclosure.



STEP 4—PUT COVER BACK ON

Finally, with the job completed, the cover is slipped back on, and two screws hold it firmly in place. The entire operation is simple and easy. It saves time and money.

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MANUAL STARTING SWITCHES FOR SMALL MOTORS

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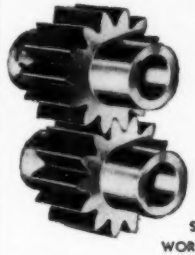
CINCINNATI GEARS

Simplify

Your DESIGN PROBLEMS



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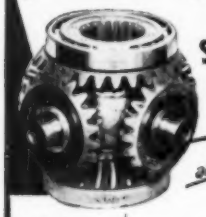

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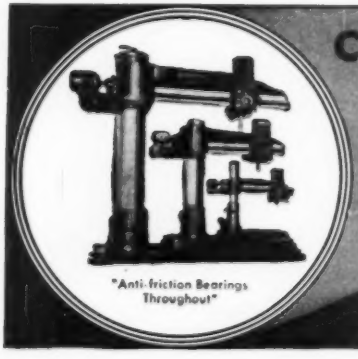

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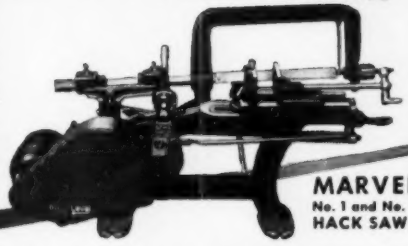

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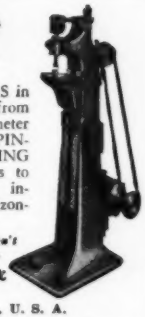

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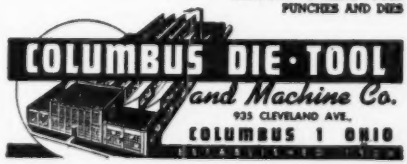

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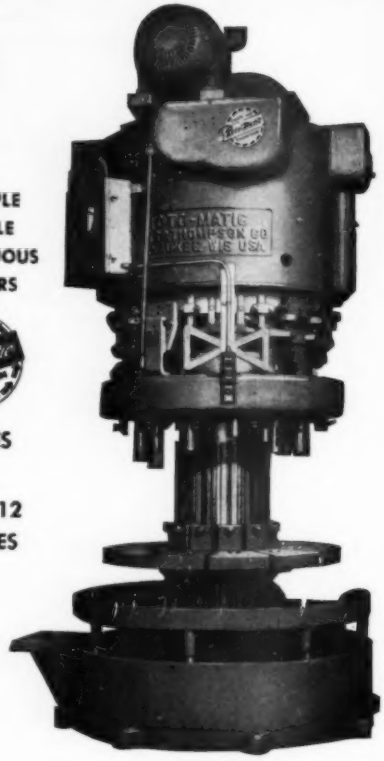

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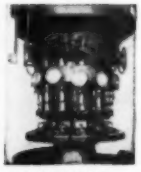

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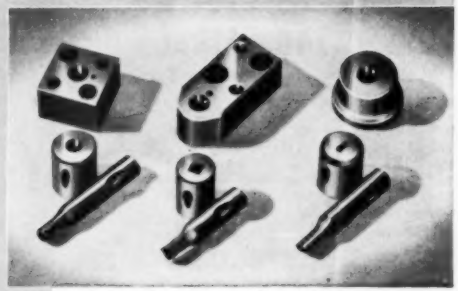

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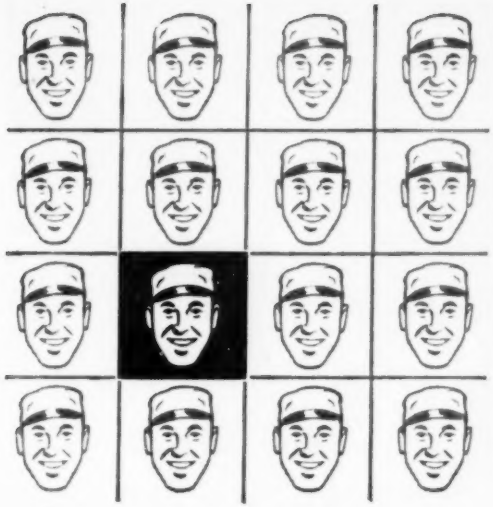

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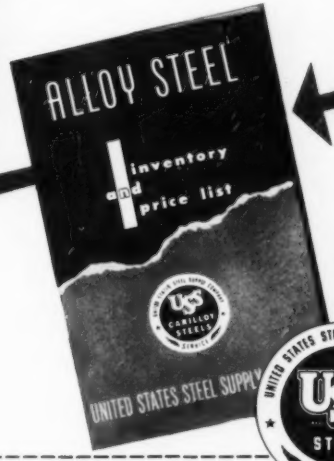

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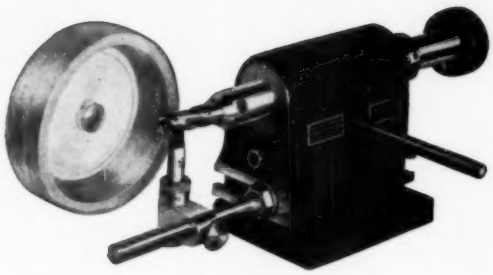

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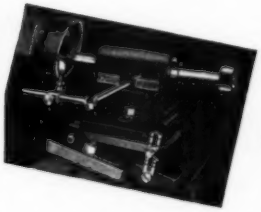

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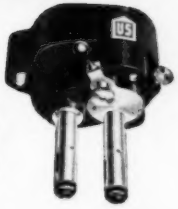
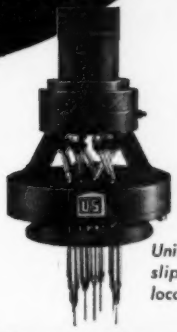


Two spindle head unit — one spindle fixed, the other spindle adjustable, for the fixed positions.



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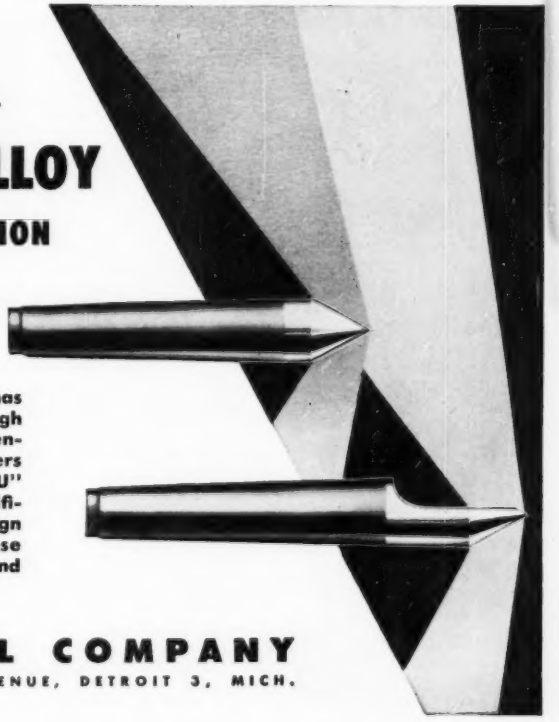

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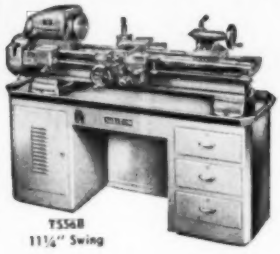

TS56B
11¼" Swing

(1) When it is too large and complex for any but the most experienced to operate safely.

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(3) When the tool investment is out of all proportion to the requirements.

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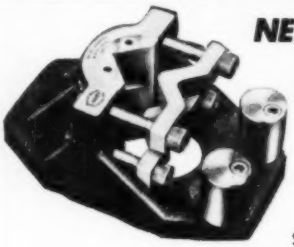

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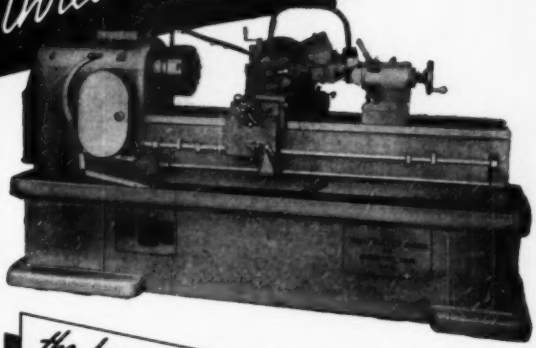

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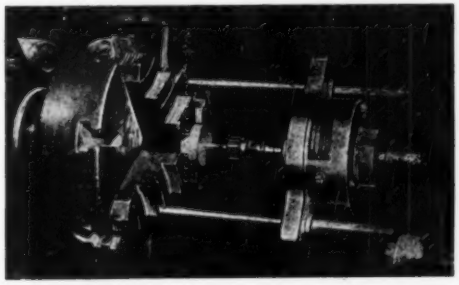

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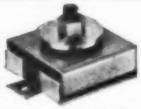

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WE HAVE an opening for a Machine Tool Designer who has had extensive experience preferably in designing large machine tools. For a capable man this is a good opportunity. Give full information regarding age, salary and experience. Replies will be treated as strictly confidential. P-9452, American Machinist.

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SOME DESIRABLE territories open to distributors for complete line of advertised patented piercing punches and die bushings. Write giving full details of lines now handled, what industries being contacted, size of sales organization and territory covered. RW-9262, American Machinist.

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We want men that know Carbide Milling, to handle our line of *Universal Inserted Tooth Milling Cutters;* stocked in sizes from 1½" to 14" Dia. These practical Cutters have advantages and application over any cutters on the market. If you can sell superior merchandise at competitive prices; write us at

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In key cities to distribute entirely new multiple spindle drill head line. Liberal commissions on this dependable fast moving product.

RW-9417, AMERICAN MACHINIST
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Wanted by old established and successful company building high grade machine tools. Good opportunity for capable Engineer. Should have designing as well as practical shop experience. Plant is modern and company progressive, has highest financial rating and is leader in its field. Located in attractive residential section of upper New York State.
Applications will be treated as confidential and should give particulars as to experience, age, references, etc.

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SALARIED POSITIONS $3,500-$35,000. If you are considering a new connection communicate with the undersigned. We offer the original personal employment service. 39 years recognized standing and reputation. The procedure of highest ethical standards is individualized to your personal requirements and develops overtures without initiative on your part. Your identity covered and present position protected. Send only name and address for details. R. W. Bixby Inc., 266 Dun Bldg., Buffalo 2, N. Y.

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TOOL ENGINEER: Experienced in tool design, processing, machine time, and estimating—10 years shop experience. PW-8964, American Machinist.

ENGINEER: AGE 38, aluminum, zinc die cast dies, tools and product, 18 years experience of design, shop and production. Desires responsible position. PW-8727, American Machinist.

PRODUCT DESIGN engineer with over twenty years experience in designing electric appliances, homecraft tools, electric and mchanical devices. College graduate with technical and practical knowledge of modern designing for mass production. Age 45. Knows tool designing and manufacturing methods. Capable of taking complete charge of engineering department. PW-9458, American Machinist.

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SEVERAL YEARS Mechanical and sales training. Thorough knowledge of machine tools, small tools, dies, jigs, fixtures, gages and their application. Good contacts in Northern New Jersey and Southern New York State if interested in a man with the above background and one who can produce results. SA-9297, American Machinist.

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SALESMAN AGE 35, desires connection with well established manufacturer of machinery, machine tools, hand tools, etc., as representative for Southwestern Area. 6 yrs. electrical maintenance in large utility power house, 4 yrs. engineer in large industrial power house, 8 yrs. selling. Lifetime resident of Southwest. RA-9367, American Machinist.

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MECHANICAL ENGINEER with shop, design, and sales experience has $20,000 to invest in small going shop where services could be utilized to advantage. BO-9451, American Machinist.

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before U.S. Patent Office, Validity and infringement investigations and opinions. Booklet and form "Evidence of Conception" forwarded upon request. Lancaster, Allwine and Rommel. Registered Patent Attorneys, Suite 453, 815-15th Street, N. W. Washington 5, D. C.

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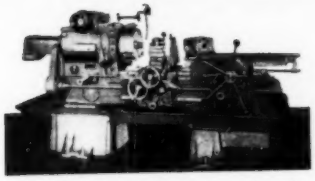


Gisholt #4 Universal Grd. Head Ram Type Bar Feed Turret Lathe. 2" Capacity. 12 speed hd. Hydraulic Speed Selector. Has tooling & coolant system.

TURRET LATHES

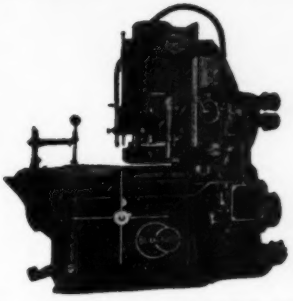
Bardons & Oliver #1 Electric Turret Lathe. ¾" cap. Has bar feed & collets.
Merey #2 Geared Head 1" Cap., M. Dr.
Simmons Microspeed 1" Cap., M. Dr.
Oster #601 Hand Screw, Machine 1½" cap.
W-Swasey #4 Univ. 1½" cap., M. Dr.
Jones & Lamson #3 Univ. Bar Feed 1½"
W-Swasey #3 Univ. 1½" cap., M. Dr.
Bardons & Oliver #7, Univ. 2⅛" Cap.
W-Swasey #3A Univ. 3½" cap., M. Dr.
Warner Swasey #1A Universal Heavy Duty Saddle Type Turret Lathe. Serial #648220. Capacity—2½" rd., Grd. Hd. 12 speeds. Coolant system, bar feed, chuck & tooling. Immediate delivery Excellent condition. Hydraulic Speed Selector.

Dreis & Krump #458D Motor Driven Power Press Brake. Serial #5439. 7½ h.p. 3/60/220/440 volts motor. Also ram motor. Push button controls. Capacity—8'x¼" steel and lighter. Takes 8'6" between housings. Throat—8". Stroke—3". Die Space—12". 30 strokes per minute. Has Standard Die Holders, also Adjustable gauges.

ENGINE LATHES

LeBlond 36"x30' Q.C.G. Hvy. Duty Geared Head Screw Cutting Engine Lathe. Serial #NK-230. 12 Speed Head. 36" internal grd. faceplate, Taper Attachment, Dial Thrdg, Set of toolholders. Max Swing—39". Centers—22'6". 25 h.p. 3/60/220/440 volts V-belt drive.
24"x16' American Q.C.G. Motorized Cone Head. 11' centers. Taper Attachment 24" chuck, faceplates, cabinet type legs. 220/440 volts motor & controls.
24"x12' Putnam Motorized. On raising blocks to swing 32" with 66" c.c.
20"x10' American, Q.C.G. 72" centers.
20"x10' Hendey Motorized.
20"x8' Lodge & Shipley. Q.C.G. M. Dr.
18"x8' Davis Q.C.G. 42" centers, equipment.
18"x8' Lodge & Shipley, geared head.
18"x8' Hendey Q.C.G. 49" centers.
18"x6' American, Geared Head, M.D.
16"x8' Hendey Q.C.G. M. Dr.
16"x6' Lodge & Shipley Geared Head.
16"x6' Lodge & Shipley "Patent Head," Motor Dr.
16"x6' South Bend Enclosed Head, Motor driven. Taper Attachment, Chucks, Collets & Quick Acting Collet Chuck.
14½"x6' South Bend Enclosed Head, Motor Driven. Taper Attachment, Chucks, Turret Toolpost Threading Dial, Ram Type Turret Attachment, Collets & Collet Chuck.
14"x8' Reed-Prentice Eight Speed Selective Geared Head, Q.C.G. Motor driven w/220/440 volts motor & controls. Has Taper Att. chuck, faceplates, steady rest, cabinet legs, max. centers —48". Completely rebuilt. Immediate shipment.

BETTS 100" Special Vertical Boring and Turning Mill. 1944 Machine. 2 Plain Heads. Complete electrical equipment. Excellent condition. Immediate delivery.



Blanchard #16 Motor Driven Vertical Rotary Surface Grinder. 26" Chuck with power down feed to head. Built-in coolant system.

GRINDING MACHINES

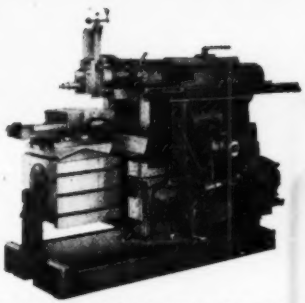
Cincinnati 10"x36" Plain Hydraulic Cylindrical Model #EA. Serial #5P2D1L-19. Filmatic Bearings. Built-in Electrics. Hydraulic Infeed.
Heald #22 & #25, 12" & 16" Horizontal Rotary Surface Grinders, Motor driven.
Cincinnati 'Monoset' Model #OE Cutter & Tool Grinder. Motor driven. With motors & controls. Set of collets, taper & cylindrical and equipment.
Thompson 6x18 Hydraulic Horiz. Surface. Wet & dry work. 220/440 motor driven. Auto, downfeed to head. Motor driven exhauster unit.
Gallmeyer & Livingston #4 Motor Driven Universal Tool & Cutter Grinder. W/Internal Attach. & Thrd. Chaser & Equipment. Motor driven coolant.
Norton 6x18 Vertical Rotary Automatic Surface Grinders. 220/440 volts motors. Excello Spindles. Hydraulic Table feeds. Three Available with immediate delivery. Also 6x18 Horizontal.

AUTOMATICS

#OG & #00 Brown & Sharpe Automatic.
#2G Brown & Sharpe Standard Speed. 220/440 volts motor & push button controls. Complete coolant, turret tooling, collet & collet chuck, toolblocks. FOUR AVAILABLE—FROM STOCK.
#2 Brown & Sharpe Automatic Turner drive 220/440 volts motor. With Stock stands, collet, toolposts, coolant system, change gears. FOUR AVAILABLE.
Cleveland Model "A" 3¾" capacity Single Spindle Motor Driven Automatic. Has lot of tooling, collets, motors and switches & coolant system. 1943.

PUNCH PRESSES

O.B.I. Johnson (NEW) all sizes, geared & plain.
O.B.I. Federal #3, 26 tons cap. motor dr.
O.B.I. Toledo #5, 44 tons cap. motor dr.
O.B.I. Bliss #18, 19C, 20, 20B, 21 motorized.
O.B.I. Michigan, 36 tons cap. Wide ram & bed.
Geared S.S.S.A. Bliss #305 Motor driven.
Wheel Press, Niles, B & Pond Horiz. Hydraulic. 200 tons cap. 48" between strain bars.
Stamping, Ferracute #86 Wide Frame, 61½" between housings. 13¾" stroke. Motor driven.
Transfer, Nilson 56 tons S.S. Dble. Crank 3-Die.
BLISS—Consolidated #77 Open Back Gap Frame Back Geared, 150 Tons Cap. M.D.



GEMCO 20" Standard Duty Universal Motor Driven Shaper. (NEW) Power Rapid Traverse horizontal & vertical. 8 Cutting Speeds, 18 cross feeds. 5 h.p. 3/60/220/440 volts V-belt drive. With 12" Vise & set of wrenches. Immediate delivery.

SHAPERS

Shaper—Columbia 32" B.G. Crank motorized Power downfeed to head.
Shaper—Logan 7" Horizontal. NEW.
Shaper—Machinery Sales 16", motorized.
Shaper—Smith & Mills 16" motorized.
Shaper—Smith & Mills 16" Universal.
Shaper—Gould & Eberhardt 16", motorized.
Shaper—Gould & Eberhardt 18" B.G. Crank.
Shaper—American 24" crank, motorized.

MILLING MACHINES

Nichols Head, Late Type, M.D. (six)
Hardinge B.B. Vertical, Bench.
Becker #5C Vertical, Cone Dr.
Cincinnati #3, #4, #5 Pl. Horiz.
Brown & Sharpe #12 Production. 18" Autom.
Brown & Sharpe #12 Production. 24" Autom.
Brown & Sharpe #0, 1, 1Y Horizontal.
Kempsmith #1, #2 Plain Horiz.
Cincinnati 18" Mfg. Plain.
Milwaukee #2K Vertical, M. Dr. Dial Type.
Milwaukee #3K Vertical, M. Dr. Dial Type.
Milwaukee #1½ Dbl. Overarm, Horiz.
Milwaukee #2B Dbl. Overarm, Horiz.
Milwaukee #3B Plain Horizontal.
Pratt & Whitney #2 Duplex, Motorized.
#3 Dial Type, H.S. Cincinnati Vertical Mill. Power Rapid Traverse, speeds up to 1300 r.p.m. Range—34"x16"x16" Head has 6" vertical with four stop indicator. Serial #4A3V1L-61. Timken Bearing. 10 h.p. motor drive in base. Two available.

UNIVERSAL MILLING MACHINES

LeBlond #4 Hog Duty. 40x10x14 M. Dr.
Ames Bench, 12" x 3" x 7½" W/Index Hd.
Index #40H, 16"x81½"x16"
B & S #2, 20"x5"x17½".
R & S #1½, 20"x7"x18".
Bridgeport, 20' x 9' x 16" Turret Type.
Garvin #2MU, 24"x8"x18".
K & T "Milwaukee" #2, 28"x10"x17".
Kempsmith #2, 28"x8½"x18"
Cincinnati #2, 28"x10"x18"
Cincinnati #2M, 28"x18"x18".
B & S #3, 34"x10"x21".
Cincinnati #3S, 34"x12"x20".
Some w/index heads & equipment.

RADIAL DRILLS

Cinci-Bickford 6' Arm, 15" Col. 24 Speeds.
Cinci-Bickford 5' Arm, 13" Col. 24 speeds.
Fosdick 5' Arm, 14" Col. Hvy. Duty, Motorized.
American 4' Arm, 11" Col. Motor on arm.
Cinci-Bickford 3' Arm, 9" Col. 12 Speeds.

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16"x48" CINCINNATI UNIVERSAL
6"x30" LANDIS TYPE C
16"x72" NORTON TYPE C PLAIN
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BRAKE. Warco 1000 Ton. Cap. 36' x 1/2"
CRANES. 5 Northern 10 Ton. 28' span
CRANE. 7 1/2 Ton. Wright. 30' Span. Monorail
CRANE. Shaw EOC. 15 Ton. 45 1/2' span
CRANE. Shaw EOC. 10 Ton. 25' span
CRANE. Shaw EOC. 15 Ton. 25' span
DRILL. American Hole Wizard 6' Arm 17" Column
DRILL. Sibley. Single Spindle 3 Taper
DRILLS. 2. Baush W7. 28 and 30 spindle
GAS CUTTING. Linde Portable CM16
GAS CUTTING. Airco 4 Portable
GAS CUTTING. Airco Travograph 96" wide cut
GRINDER. Hanchett Surf. 120"x28" table mag. chucks
GRINDER. Blount Wet Tool 2 1/2x20" wheel
GRINDERS. Carboloy dbl. spdl. 10" and 14"
JIG BORER. Reed-Prentice 5. 16x16 table
KEYSEATER. Davis 5. Cap. 1/16—1"
LATHE. Carrol-Jamieson 8" x 30"
LATHE. Warner & Swasey 3A
LATHES. 2—LeBlond 16"x100"
LATHES. 2—Spafld. Eng. 20x84", 27x120"
LATHE. Gisholt 2L 3 1/2" Hollow Spindle
LATHE. Gisholt 3R. Turret
LATHE. Lodge & Shipley Oil Country 25x72"
LATHE. Crozier Polishing 1CPL
LATHE. Hammond Buffing 7VROW 72" Shaft
LATHE. U. S. Buffing 95—66" Shaft
LATHES. 2—Warner & Swasey 4—Hand Screw
LATHE. Pittsburgh. Engine 48"x28'
MILLER. Cin. Vert. Hyd. 28x133" table
MILLERS. 33—Cleve. Vert. 1. 8x32 table
PRESS. Fed. Hyd. 115 T., 24" str., 19x24 1/2 bed
PRESS. Warco 75 Ton. Horn
PRESS. Warco 75 Ton. O.B.I.
PRESS. Warco 200 T., 84"x42" bed. 16" str.
PLASTIC MLDRS., 2-Fed. Inj. Type 250 Ton
PLANER. Cin. Hypro Openside 72x72x15'
REVOLVING TABLE. 7' mtrized. for hor. mills
REVOLVING TABLE. 4' mtrized. for hor. mills
ROLL. Bertsch Initial Type. Cap. 1 1/2"x10'
ROTOBLAST. Pangborn Barrel Type
SAW. Black and Decker—Portable 7" blade
SAWS. DoAll Contour 36" Table 30x30"
SAWS. 2. Marvel 6A Hack Saws. 6x6 cut
SAWS. DeWalt GL. 22" wood cut-off
SAWS. Porter Cable. Portable 10" blade
SHEAR. Williams. White—Cap. 3/4x10'
ELDER. Federal. Projection 75 KVA
WELDERS. 2. Federal Flash. 750 KVA
WELDERS. 12—G.E. Arc. 300 Amp. AC
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GIDDINGS & LEWIS #25T, 2½" Bar, latest
GIDDINGS & LEWIS #45, 3" Bar Table Type, latest
LUCAS #41, 3" bar, Table Type, Latest Type
NILES-BEMENT-POND 5", 5" bar, fl. type, M.D.
UNIVERSAL 4" bar, high speed, latest type
BORING MILLS—Vertical
BETTS 120", 2 swivel heads, AC, Motor Drive
BULLARD 8" 8 Spin. Mult-Au-Matic, Type J, latest
BULLARD 12" 6 Spin. Mult-Au-Matic, Type D, latest
BULLARD 16" 6 Spin. Mult-Au-Matic, Type D, latest
BULLARD 24", 36", 42" "Spiral Drive," Latest Type
BULARD 62" "Maxi-Miller," 2 heads, Motor Drive
COLBURN 72", 2 Swivel Heads, PRT, M.D.
KING 62", 2 swivel heads, PRT, M.D.
NILES 100", 2 swivel heads, PRT, DC, M.D.
BRAKES—Power
CINCINNATI Series 200 ½" x 8' 6", M.D.
CINCINNATI Series 50, 3/16" x 8', Latest Type
VERSON #206, 10 gauge x 96", Latest Type
GEAR CUTTING EQUIPMENT
BROWN & SHARPE #12 Spur & Bevel Gear, M.D.
FELLOWS #61, #7, #7A, #72, #75, #77, #Z, 6ZZ, High Speed Gear Shapers, latest type
GLEASON 2", 12" straight bevel generator, Latest
GOULD & EBERHARDT 12H, 12HS Hobber, Latest
GOULD & EBERHARDT 96H, Hobber with diff. m.d.
SYKES #1½, 18" Cap., Herringbone Gear, M.D.
GRINDERS—Cyl.—Plain & Univ.
BROWN & SHARPE #1, 2, 3, 4, Universal, Latest
LANDIS 4x12, Type H Plain Hyd., Latest
NORTON 6x18", 10x72", 14x36", Type C, Plain, latest
NORTON 6"x36", 10"x36", type C, Pl. Hyd., latest
GRINDERS—Miscellaneous
BARBER COLMAN #3, 4, hob sharpener, latest
BRYANT #16-CP-16, #24 Int. Hyd., latest
CINCINNATI #2 Centerless "Filmatic," latest
COVEL #22 Universal Tool & Cutter, Latest Type
HEALD 72A3, 72A5 "Gagematic," Internal, Latest
HEALD 75A, 72A.., 72A5, 74, 76A Internal, latest
LANDIS #12 Centerless, Hydraulic, Latest Type
GRINDERS—Surface
HANCHETT Series 200, 12x48" Vert. Sp. Hy. Latest
HEALD #22 Rotary, 12" chuck, latest type
HEALD 25A—Rotary—16" and 20" chuck, hyd., latest
THOMPSON 12x12x24 Type B Hyd., Latest Type
LATHES—Engine & Mfg.
AMERICAN 36"x360" centers, 2 carriages, motor dr.
LEHMANN 16x30" centers, TIMKEN, latest type
LeSWING 4x60, 4x84, 8x60, 8x108, 3x34, Latest
MEDART #6LSF Bar Turner, Latest Type
MONARCH 10"x20" centers, Model EE Timken, latest
MONARCH 12"x30" Centers, 12"x54" Centers, Model CK, Timken Bearing, Latest Type
MONARCH 16"x78" centers, Timken, Model CW, latest
MONARCH 22"x450" centers, 3 carriage, Timken Bearing, Model CM, motor drive
NILES 20x750" Boring, Timken, Latest Type
PRATT & WHITNEY 14"x54" Centers, 16"x30" Centers, Model C, Timken Bearing, Latest Type
SPRINGFIELD 16"x50" centers, Timken, latest type
LATHES—Turret
BARDONS & OLIVER #5, #7, Timken, Latest Type
FOSTER #4FU "Fastermatic" Timken, Latest
GISHOLT #1L, #2L, #3L, Universal, Timken, Latest
GISHOLT #3, #4, #5, Univ., TIMKEN, Latest Type
JONES & LAMSON #3, #5 Univ., Timken, Latest
LIBBEY "International" 1-H5, Univ., Timken, latest
MOREY No. 2G, No. 3, No. 4, Timken Bearing, latest
WARNER & SWASEY, #1, 2, 3, Ram—Timken, latest
WARNER & SWASEY #2A Universal, Latest Type
WARNER & SWASEY 1A Universal, Timken, Bar and Chucking, New 1947
MILLING MACHINES—Plain
BROWN & SHARPE #2, Light Type, Timken, latest
BROWN & SHARPE 2B, 3B, Timken, Latest Type
CINCINNATI 08 Auto., rise and fall, latest type
CINCINNATI #4, TIMKEN, Motor Drive
CINCINNATI 4-36, 2-18 Hydromatic, Simplex, latest
KEARNEY & TRECKER 1218, 1401, Latest type
KEARNEY & TRECKER 2H, 3H, 4H, Timken, latest
KEARNEY & TRECKER #3, 4, Hvy. Timken, M.D.
KEMPSMITH 2-G, #4, Timken, latest type
MILLING MACHINES—Vertical
BROWN & SHARPE #2B Timken, latest type
CINCINNATI #2, Dial Type, Timken, latest type
GORTON 2½"D, 9" high speed, latest
KEARNEY & TRECKER #3H, Timken, latest
REED PRENTICE 2VG, with duplicator, latest
SCREW MACHINES—Automatic
CLEVELAND 9/16" model A, high speed, latest type
CONOMATIC 6", 4 spindle, latest type
CONOMATIC 2½", 5 spindle, Latest Type
GOSS & DeLEEW 8" auto. Chucker, 5 spin., latest
GOSS & DeLEEW 6"x6¾" Auto. Chucker, Latest
SHEARS—Power
NIAGARA #2120, 10 gauge x 10', Motor Drive
QUICKWORK 5", 1" Cap. Rotary, Motor Drive
WYSONG & MILES #372, 14 gauge x 6' Latest Type
MISCELLANEOUS
BARNES #177, SHAH, 207 Vertical Hone, Hydraulic, Self-Oiling, Latest Type
CAMPBELL #401 Abrasive Saw, Latest Type
CINCINNATI Centerless Lapper, Model ED, Latest
CINCINNATI 1-20, 3-20, Duplex Vert. Surface Broach, Double ram, Model ER, Hyd., Latest Type
FOSDICK Model 42 Jig Borer, latest type, New 1947
LAKE ERIE 500 ton Vertical Hydraulic Press, latest
PRATT & WHITNEY "KELLER" Type BL-2416 & Type G Copying, latest type, 2 & 3 Dimensional
PRATT & WHITNEY ½Hx56 Rifler, Latest Type
PRATT & WHITNEY 6 x 60 "Speed Miller, latest

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Brown & Sharpe #00Q, H.S., #4, #6
Consomatic 8 sp. 1⅞" cap.
New Britain Gridley 6I—8 Sp. 2½"

BORING MILLS
Giddings & Lewis #0, #25T, Bullard, 42" V.T.L.
Universal 3" horiz., Lucas #3I horiz.

DRILLS AND RADIALS
Amer. 4'-13" col. Radial, Canedy-Otto 3'-9" col.
Carlton 8'-19" col., Foote-Burt 6 Sp.
Cincinnati #2 Centerless Filmatic, 12"x36, 12x48" Univ.
Covel #9IA Univ. Tool & Cutter
Gardner #22B, 36" diss, Heald #1 Tool, K. O. Lee Tool & Cutter, Hammond #4 Carbide
Landis #4H Cyl. 4x12", Landis #6 Thread, Centerless
Norton #2 Tool & Cutter, Porter Cable Belt WG6
Norton Cyl. 6x18" Type C, 6x30" Type C
Oliver #510 Drill Pointer, Sellers #4G
Pratt & Whitney Radius #R6, Greaby Int.

GRINDERS—Surface
Abrasive #1½" Wet, #34 Vertical, #33
Atlantic 6x18" Power Feed, Foote-Burt Hammond
Blanchard #18—42" Chuck
Brown & Sharpe #2
G. & L. #18, 6x18" Hand Feed, #25, #35 Hyd.
Hanchett #300, 12x48"—Mattison 14x16x48 Hyd.
Norton 6x18" Hyd., Pratt & Whitney 12x36" Vert.
Reid #2A P.F., #2C Pops & Excello Spdl.
Thompson Hyd. 6x10x18", 6x12x18

LATHES
Bradford 16"x6', Hardinge Precision 9", cabinet
Hendey G. H. 16x30 with relieving att.
LeBlond Regal 16"x3½", 15x30", 19x48", 21x60"
Lodge & Shipley 16x78" T.A., LeBlond HD 16x33"
Monarch 10"x20" EE, 10x78" T.A., 12x30" CKK
Rivett Precision, Logan 10"x30"
South Bend 9"x3', 9"x3½', 13x36", 10" Cabinet
Sebastian 12"x4', G.H., Sheldon 11x24, 1" collet

LATHES—Turret
Asmo #6W Bar and Chuck, 6W Fox Lathe
Bardons & Oliver #3, #5, Foster #3B
Brown & Sharpe #1, #2F Hand Screw Mach.
Gisholt #4, 5 Bar & Chuck
Jones & Lamson #8A Univ., Hardinge ESM
Oster #60I Rapiduction, Morey #3, 1½" cap.
Warner & Swasey #3, #4, #4A—6" Bar Cap.

MILLS—Plain & Universal
Brown & Sharpe #2B Pl., #2A Univ.
Cincinnati #3 Plain, 2MH Univ.
Milwaukee #2HL, 2H, Plain, #2HL, 2H, 3H Univ.
Van Norman #12, 20, 22L, 56

MILLS—Vertical—JIG BORERS
Brown & Sharpe #2, Index, Vernon, Bridgeport
Cincinnati #4 Dial Type, Jackson
Fosdick Jig Borer #42 Like New 1947
Gorton #8D, 9J Plain, #8½D Duplicator
Kearney & Trecker #3H, 3N High Speed
P&W 1½B Jig Borer, 8Jp Jig Borer #MP-5
Moore Jig Grinder, Vernon jig borer
Morey #12M Profiler 2 sp.—Pratt & Whitney 12B

MILLS—Production
Brown & Sharpe #00B, 12, 2I
Cincinnati #1-12, 1-18, 2-18 Mfg.
Nichols Hand, U.S. MM I, Kent Owens #1V
Sundstrand #00 Rigidmills, U. S. Duplex

PRESSES
Bliss #8 Dbl. Crank, Bed 42x106", 250 Ton
Bliss #675, 645B, 630 Hi-Production, 304A, 385A
Bliss #2B, 2I O.B.I., #4½ Double Action Cam
Bliss #5B O.B. Gap Frame #6Z, 62A, 16Z
Henry & Wright 25, 60, 75 Ton Dieing; Reliance 45, 45 ton O.B.I.
Reliance 45 ton O.B.I.
Thomas 7A, 80 Ton O.B.I., Gen. Flex Elec. Screw
V. & O. #25B O.B.I., #102 Reducing, Z & H 30 Ton

MISCELLANEOUS
BAND S&W: DoAll Metalmaster, Tannewitz #36M
BENDING ROLL: Buffalo #9, Excelsior #14
BROACH: 3L LaPointe Horiz. Hydr.
HACKSAW: Marvel #6A Automatic, #6, #4B
HAMMER: Niles Bement Pond 2500 lbs. steam
HONER: Micromatic #M-I Hydrohoner, Sunnen
INJECTION MOLDER: Reed-Prentice #10D6, 8 ounce, 8 ounce heating cycle
IRONWORKER: Buffalo 25U x 20 Univ.
KEYSEATER: Mitts & Merrill, Baker Davis
PRESS BRAKE: #253, #335 Chicago
ROUTER: Onsrud #W240, #55 Oliver
TAPPERS: Bakewell #1, Haskins #2C, 3C
THREAD ROLLER: Waterbury-Farrel #30 with Dies
WELDERS SPOT & SEAM: Sciaky, Thompson, Taylor Winfield
WRAPPING ROLL: Buffalo #½

HYDRAULIC EQUIPMENT

Cap.	Manufacturer	Platen Stroke	Opening
500 Ton	Lake Erie	35x35"	36" 68"
800	Bald. S'thw'k	76x56"	22" 30"
500 D.A.	H.P.M.	36x36"	24" 30"
1000	French Oil	53x42"	28" 50"
500	Brand New Watson Stillman Hobbing Press		
375 D.A.	Elmes	84x44"	12" 42"
350	Verson	48x40	36" 72"
50	Dennison	22x20	18 23
150	Southwark	34x30	30 2' to 4'

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300 Ton Dunning & Boschert Molding Press
500, 800 Ton Waterbury-Farrel 3 & 4 Rod Presses
300 Ton Watson Stillman Press, 24x20" Platens
400 & 500 Ton Shaft Straighteners—Self Contained

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Gray Turret Head Metal Cutter, cap. ¼", 30" throat
No. 2 Libert Nibbler, 28" throat
Southwark Rotary Metal Cutter, 36" throat, m.d.
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15" Canada, m.d.
20-24" Dill, m.d.
48" Niles-Bement-Pond Geared, m.d.

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No. 1 Bakewell Precision, m.d.
No. 1R Bakewell Precision, Radial Tapper, m.d., latest
No. 2 Bakewell Precision, m.d.
No. 5 Webster & Perks, belt
No. 10 Kaufman High Duty Oscillating Pneumatic, m.d.

SHAPERS

18" Invicta Shaper, m.d. thru gear box, new
24" Invicta Shaper, m.d. thru gear box, new
24" Potter & Johnston, cone
32" Morton Draw-Cut, m.d., late
36" Morton Draw-Cut, m.d., late
48" stroke Heavy Duty Morton H.D. Traveling Head Draw-Cut Shaper, m.d., with d.c. variable voltage equipment, 12' bed, latest type

MISCELLANEOUS

No. 12E Gisholt Static Balancing Machine, m.d., latest
No. 2A Pratt & Whitney Jig Borer, m.d.
Gisholt Precision Balancing Machine, m.d.
96" Ohio Extra Heavy Worm Feed Revolving Table, m.d.
40" Tolhurst Chip Wringer, m.d.
Detrick & Harvey 2 spindle Profiler
No. 12M Morey 2 Spindle Profiler, m.d., latest
No. 12 Pratt & Whitney 2 spindle Profiler, m.d.
No. 20 PH AD. Cook Deepwell Pump with Chrysler Engine and 200' of 6" pipe, brand new
Wagner Saw Sharpener, m.d.

HAND MILLING MACHINES

United States, vee belted m.d.
No. 1 Kent-Owens, m.d.
Atlas Model MF Bench, m.d.
No. 1 Standard, m.d.
No. 2 Productomatic, m.d
No 3 Garvin, m.d.

PLANERS

P10 Coulter Crank Type Shaper-Planer, 1 head, m.d.
20"x20"x5' Whitcomb-Blaisdell Planer, belted m.d., 1 head
24"x24"x6' Cincinnati, m.d., 2 heads
21"x24"x10' Whitcomb-Blaisdell, 2 heads, m.d.
30"x30"x10' Gray, 2 heads, belt
30"x30"x14' Gray, 2 heads, belt
32"x32"x16' Gray, 2 heads, belt
36"x36"x10' Niles, 2 heads, belt
36"x36"x18' Niles-Bement-Pond, 2 heads, reversing m.d.
36"x36"x20' Cincinnati, 2 heads, belt
36"x36"x20' Gray, 2 heads, belt
36"x36"x26' Cincinnati, 2 heads, belt
42"x42"x26' Gray, 2 heads, belted m.d.
48"x48"x18' Detrick & Harvey, 4 heads, reversing m. d.
48"x48"x28' Cincinnati, 4 heads, reversing m.d.
48"x48"x30' Cincinnati, 4 heads, m.d.
48"x48"x32' Niles-Bement-Pond, 4 heads, reversing m.d.
48"x48"x40' Sellers, 2 heads, reversing m.d.
62"x62"x40' Cincinnati, 4 heads, reversing m.d.
66"x66"x40' Niles-Bement-Pond, 4 heads, reversing m.d.
72"x72"x16' Niles, 4 heads, reversing m.d.
96"x72"x18' Pond, 4 heads, belted m.d.

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6x6" Peerless Hack Saw, m.d.
6x6" Peerless Hydraulic, m.d.
6x6" Peerless Universal, m.d.
7½ H.P. Cincinnati Elec. Tool Co. Abrasive Cut-off Machine type JCAW
DeWalt Model ME 1 Abrasive Cut-off Machine, m.d.
No. 3 and 8 Nutter & Barnes Cold Saws
No. 6 Cochran Bly Cold Saw
No. 13B Espen Lucas Cold Saw, m.d.
Gustav Wagner Cold Saw, m.d.

PRESSES

No. 3 Bliss Stiles Type Press, belted m.d.
No. 20 V & O, m.d.
Ferracute Double Crank, 36" between uprights, 84 ton cap.
90"—400 ton Niles Driving Wheel Press, m.d.
Chambersburg 30 ton Hydro-Pneumatic
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No. 346T GIDDINGS & LEWIS Table Type Horizontal Boring Mill, 4" bar, 2" auxiliary spindle, 1943	5'-15" col. AMERICAN "Hole-wizard" Radial, box table, 1942
No. 4H LIBBY Turret Lathe, 12" hole in spindle, 3 and 4 jaw chucks, 1943	16"x54" LODGE & SHIPLEY Toolroom Lathe, taper, chucks, 1943
No. 4A WARNER & SWASEY, full leadscrew, taper attach., tooling, 1942	36"x20' bed AMERICAN High Duty, Timken spindle, Engine Lathe, 12' centers, 1942
No. 3A WARNER & SWASEY, bar feed, taper attach., threading attach., tooling, 1942	No. 3 CINCINNATI Dial Type Milling Machine, vert. head, 1941
No. 2A WARNER & SWASEY, bar feed, taper attach., threading attach., tooling, 1942	No. 5 CINCINNATI High Power Milling Machine, vert. head, 1943
No. 2A WARNER & SWASEY, bar feed, 4' extra bed length, taper attach., steady rest, 1941	No. 24 BRYANT Internal Grinder, 1942
24" GOULD & EBERHARDT "Industrial" Shaper, 1942	10 ton DOMINION Crane, 42' span, AC motors, 1941

In addition to the above machines there are many other Lathes, Milling Machines, Drill Presses, Tool & Cutter Grinders, Planers and Shapers. In all, there are sixty-five machines available in this plant. All machines motor driven 3/60/220/440

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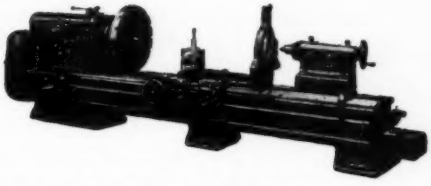

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4—15-Ton P & H Overhead Electric Traveling Cranes
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LATE TYPE MACHINE TOOLS

AUTOMATICS
6" RPA-6 Acme Gridley Chucker. 1941.
16" Bullard Mult-Au-Matic, 6 spdl. '41.
1⅝" Greenlee, 6 spindle. 1942.
9/16" RA-6 Acme Gridley. 1942.

BORING MACHINES
No. 42 Lucas Horizontal. 1940.
No. 54 Excello Double End. 1940.
No. 49 Excello Double End. 1942.

DRILLS, HEAVY DUTY
No. 121 & 217 Baker. 1941.
W-6 Baush Hyd. Mult. Spdl. 1943.
No. 40 Fox Multiple Spdl. 1944.

DRILLS, RADIAL
4'9" Cincinnati Bickford. 1944.
3'9" Cincinnati Bickford. 1940.

GEAR EQUIPMENT
3" & 12" Gleason Generator. 1941.
12" Gleason Rougher. 1943.
No. 6 & 17 Gleason Testers. 1943.
12" Red Ring Internal Shaver. Late.
No. GCL-3 Red Ring Shaver. 1942.
No. 6A & 712 Fellows Shapers. 1942.
No. 18M Fellows Finisher. Late.
Vinco Spline & Gear Grinder. 1942.

GRINDERS, CYLINDRICAL
16"x36" Cincinnati Plain. 1942.
12"x48" Cincinnati Univ. 1943.
10"x72" Landis Plain. 1942.
10"x18" Norton Plain. 1942.

GRINDERS, INTERNAL
No. 74 Heald Ext. Bridge. 1941.
No. 72A3 & A5 Heald Plain. 1944.
No. 5 & 16A22 Bryant. Latest.

GRINDERS, SURFACE
14"x36" P&W Vertical. 1938.
No. 22 & 25A Heald Rotary. 1943.
No. 2B Reid. 1942.

LATHES, ENGINE
32"-45"x22' Axelson. 1942.
28"x28' Bertram. 1942.
24"x168" Sidney. 1942.
18"x54" Lodge & Shipley. 1943.
14"x54" Reed Prentice. 1942.

LATHES, PRODUCTION
Gisholt "Simplimatic". 1943.
No. 3A L&S "Duomatic". 1943.
No. 2FU Foster "Fastermatic". 1943.
20"x97¾" LeBlond Rapid Prod. 1941.
8"x108" Lo-Swing Semi. Auto. 1942.
Model 10 & 12 Sundstrand. 1942.
14"x42" Monarch "Magna-Matic". 1941.

LATHES, TURRET
36" Bullard Vertical. 1943.
No. 2A & 3A Warner & Swasey. 1943.
No. 1 & 8½"x24" Acme Univ. 1943.
No. 3L Gisholt. 1941.
No. 2, 3, 4 & 5 Warner & Swasey. 1943.
No. 2, 3, 5 & 7 Bardons & Oliver. 1942.

MILLS, PLAIN
No. 5 Cincinnati. 1943.
No. 4H & 4K Milwaukee. 1943.
No. 3 Van Norman. 1942.
No 2HL Milwaukee. 1942.

MILLS, PRODUCTION
BL-2420 P&W "Keller", 3 sp. 1942.
BL-2416 P&W "Keller", 1 sp. 1943.
BG-1 Keller, single spdl.
No. 1848 Kearney & Trecker. 1942.
No. 1248 Kearney & Trecker. 1942.
No. 1-18 & 2-18 Cincinnati. 1942.

MILLS, THREAD
6"x60" Pratt & Whitney. Latest.
12"x54" Lees Bradner. 1943.
8"x16" Hanson Whitney. Late.

MILLS, UNIVERSAL
No. 2MH Cincinnati. 1942.
No. 2H Milwaukee. 1942.
No. 2SU & 2SU Van Norman. 1942.

MILLS, VERTICAL
No. 3H & 3K Milwaukee. 1942.
No. 2 & 3 Cincinnati. 1941.
No. 2K Milwaukee. 1942.

PRESSES
No. 40-51½ Minster. 1946.
No. 8R Rockford. 1946.
100 Ton [illegible], nya. 1942.
45 Ton Reliance. 1942.

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LATHES

Pratt & Whitney 16"x36" centers. Model-B. 16-speed. Gr. Hd. 14 to 576-RPM. Taper attchmts.

Reed-Prentice 16"x54" centers. Model-B Toolroom. 16-speed. Gr. Hd.. (1942) 16 to 476-RPM. 18½" swing. taper attchmt.

Bridgeford 36"x14'. 9-speed Gr. Hd., 7 to 100-RPM. 38½" Art. swing—84" C. Dist.

Bridgeford 36"x56'. 15-speed Gr. Hd., 3.05 to 150-RPM. 38" art. swing. 48' C. Dist. Rebuilt 1943—taper attchmt.—mtsd. carriage.

Sundstrand #8. 15"x15" Automatic Stub—77 to 620-RPM. (late).

Jones & Lamson (Fay) 12"x81" Automatic Univ. (very late)—155 to 1000-RPM—1⅝" hole thru spdl.

BORING MILLS (Horiz. Table Type)

Universal 4" bar. "Triway" (late). added vert. range—speed 8 to 300-RPM face plate to outer support 72"—top tbl. to centerline spdl. 48"—taper #6 Morse.

Defiance #25A—3¾" bar (late)—added vert & cross range—speed 12 to 1600-RPM—face plate to outer support top tbl. to centerline spdl. 48"—cross travel tbl. 72"—taper #6 Morse.

Bullard 36" and 42" "Spiral Drive" Vertical.

Niles-Bement-Pond 62" Vertical, standard pattern —2 hds on cross rail.

RADIAL DRILLS (Late Type)

Fosdick 5'17" column, motor-on-arm "Economax" hydraulic, #6 Taper 20 to 1400 RPM, 72" spindle to base.

Cinn.-Gilbert 4' 11"-column motor-in-base, 50 to 1800 RPM—taper #4 Morse—dist. spdl. to base 52½"—double base. (late).

Morris "Mor-Speed," 4' 9"-column Hi-Duty motor-on-arm—75 to 1500-RPM—taper spdl. #4 Morse —spdle. to base 53" (late).

MISCELLANEOUS

National-Acme R4 9/16", 6-spindle. (late)—289 to 2885 RPM—tooling & attchmts.

Potter & Johnston #5DEL Auto. Chucker, 30" swing—16" turret slide travel—5 face turret—quantity of tooling, (late).

(New)—Rafter Squaring Shears—available in two sizes:
¼"x10' Mild Steel
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1—Monarch Lathe, 22 x 48"
1—3 spindle Gould & Eberhardt spur gear and bevel rougher
1—Heald double spindle Borematic

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American Ring Metal Turnings Crusher, Type ST.T., Machine No. 2400, Serial No. 1924.
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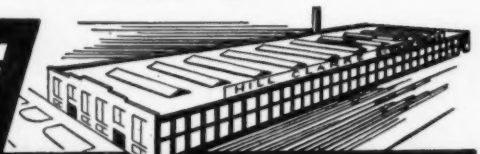

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1⅝" Greenlee, 6 Spdls. (1941)
No. 61 New Britain 6 Spdls. 1⅝" (1942)
No. 6 Brown & Sharpe
No. 49 New Britain, 4 Spdl. Chucker
Model A 2½" Cleveland (1943)
Model A 3¼" Cleveland (1942)

DRILLS
No. 150 Baker
No. D8 Colburn, No. 6 Morse Taper
No. 1-LMS Leland-Gifford's (1942)
No. 2-LMS Leland-Gifford's (1942)
No. 4BL Natco 36 Spdl.
6'-17" Col. Fosdick Radial

GEAR MACHINES
No. 61-A Fellows Gear Shaper (1942)
No. 7125 Fellows (1943)
No. 72 Fellows Gear Shaper
No. 18H Gould & Eberhardt
12" Gleason Bevel Gear Cutter
37" Gleason Bevel Gear Planer
72" Cincinnati Gear Cutter

BORING MACHINES
No. 31 Lucas, 3" bar
No. 48-B Heald Bore-Matic
No. 112—C Excello 2 Spdl.
42" Bullard New Era
42" Colburn
60" Colburn
72" Niles Extra Heavy
84" Betts

GRINDERS
3"x12" Brown & Sharpe No. 5 (1944)
4"x12" Landis, Model H (1942)
6"x18" Norton Type C Plain (1943)
6"x30" Norton Type C Plain (1943)
10"-14"x36" Norton Type C Plain (1942)
10"x18" Norton Type C Plain (1943)
10"x48" Norton Type C Plain (1943)
Norton Motorized Grinders ranging from 6"x18" to 24"x240"
No. 5—8"x24" Covel Hydr. Surf. (1941)
No. 36-A Hanchett Rotary Surface
72A-3 Heald Internal Grinder (1942)
72A-5 Heald Internal Grinder (1942)
74 Heald Internal Gdr. (1942)
Bryant Internal Grinders (1942)

LATHES
16"x54" centers LeBlond (1941)
16"x60" centers Pratt & Whitney, Model B
18"x8' American, Grd. Head
19"-38" gap x 10' LeBlond
36"x30' Lodge & Shipley
36"—48"x16' Lehman Hydratrol (1945)
8"x15" Sundstrand, Model D (1943)
10" Sundstrands (1942, 1943)
16" & 20" Fay Automatics (1942)
No. 4 Gisholt Univ. Turret Lathe (1942)
No. 4R Libby, Bar Feed (1943)
No. H-5 Libby
No. 5 Bardons & Oliver (1942)
No. 5 Midland, Bar Feed (1942)
No. 2-A Warner & Swasey
No. 1-H Libby, 6¼" Hole in Spindle (1937)
No. 1-H Libby, Extra Long Bed (1942)
18" Libby, 3½" Hole in Spindle
No. 4A Warner & Swasey, 7½" Hole in Spindle

MILLING MACHINES
No. 2 SP Van Norman Plain (1942)
No. 4 Cincinnati Plain (1943)
No. 2 H Milwaukee Vertical (1942)
No. 2 Cincinnati Vert. (1942)
No. 2M Cincinnati Vert. (1941)
No. 3 Cincinnati H.P. Vertical
No. 1-18 Cinn. Mig. (1940)
No. 2—18" Sundstrand-Electromil (1942)
No. M-24 Milwaukee Simplex (1942)
30"x40"x10' Fitchburg Duplex Miller (1943)
No. 4-48 Cincinnati Hyd. Tracer (1942)
No. 34-48 Cincinnati Hyd. Duplex
No. 45-48 Cinn. Hyd. Duplex
No. 56-72 Cincinnati Hydromatic
4½"x12" Pratt & Whitney, Model C
6"x36" Lees-Bradner—Model HT (1943)
10"x48" Hanson-Whitney Thread
24"x24"x12' Ingersoll Adj. Rail
36"x36"x16' Ingersoll Slab Miller
No. 10 Ingersoll 72"x6' Travelling Col. Face Millers (1942)

MISCELLANEOUS
18" Dill Slotter
Micromatic Vertical & Horizontal Hydrohoners
8-M Wells Band Saw

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36"x36"x12' Cincinnati
36"x36"x18' Gray, 4 Heads
48"x36"x14' Gray
48"x48"x12' Cincinnati, 4 Heads

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G & L and Universal 3" Bar Horiz. Boring Mills
Oreis & Krump 10' Press Brake, No. 14 — Ga. M.D.
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20" All Grd. Camel Back Drill
Cin-Bick 3' & Morris 3½' Arm Radial Drills
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Blanchard M.D. Vert. Sp. Surface Grinder 26" chuck
L & S 20" x 8', 18" x 12', 20" x 10', 28" x 12'
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Cleveland 48" x 12' Table Open-side Planer, 3 Hds.

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All above with A. C. motors.

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With Turchan Follower
Excellent Mechanical Condition
PRICE $9,000.00
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HYDRAULIC CONTROL VALVE OIL HYDRAULIC PUMP

BRAND NEW control valve with built-in adjustable relief valve, will operate one double-acting hydraulic cylinder or 2 cylinders as one or a reversible hydraulic motor. Valve handle latches in neutral position. Made of rugged cast aluminum alloy. Open center unloads the pump in neutral position. Throttling control allows operator to regulate the speed of movement of the hydraulic cylinder or motor. Has removable mounting brackets with 4 bolt holes, ⅜" pipe thread connections.
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BRAND NEW. For double-acting pneumatic devices. Fine for operating presses, air vises, air machinery of many types. Heavy duty cast construction. No neutral position. Maintains pressure against the piston when the foot control is in the "Up" position. Dimensions of valve body: 7⅝" L x 6¼" W x 7⅛" H. Net wt. 28 lbs.
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HYDROHONER—Micromatic Model #4H (1943)
LATHE—Bamford-Chase Tool Room, 14"x6' Taper. Late Bridgeford, Engine, g. head, 32"x21' centers.
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72"x72"x16' Cincinnati Hypro Motor Drive with A.C., M.G. Set New 1943—Excellent Condition.
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AUTOMATICS

Consomatic 1⅞", 8 spindle
Cleveland, Model AA-08

BORING MILLS

Cleveland #1, 2½" bar, MD (Horiz.)
Bullard New Era, 24", Side Head, MD
King 34", one rail head, MD
Niles 36-44 Vert. Turret Side head MD
Bullard Maxi Mill 54", two rail heads, MD
Defiance #6 Horiz. 4½", MD

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American 14"x6'—14"x8', 3 SCD, BG, Bowl Head
American 16"x6'—16"x8', 3 SCD, D.B.G.
American 16"x6'—16"x8' GH, MD
American 18"x6'—18"x8'—18"x10' GH, MD
American 18"x8'—18"x10' 3 SCD, DBG, Bowl Hd.

American 42"x16' bed Internal Face Plate Drive GH Engine Lathe

Boye & Emmes 18"x8' SCEL
Boye & Emmes 18"x8' SCEL
Boye & Emmes 20"x10' SCEL

LATE TYPE

Boye & Emmes 16"x54" GH & QCG

Boye & Emmes 24"x16' HD, GH
Boye & Emmes 26"x16' QCG, MD
Boye & Emmes 40"x30' GH
Hendey 14"x6' Model EBM, Tool Room, MD
Hendey 14"x6' 4 SCD, Yoke head
Hendey 18"x8' 4 SCD, Yoke Head, Tool Room
LeBlond 14"x6'—14"x8' 4 SCD, BG
LeBlond 14"x6' GH, MD, BG
LeBlond 17"x6'—17"x8' GH, MD
LeBlond 17"x8' 3 SCD, Hi Duty, DBG
LeBlond 21"x6'—21"x10' HD, 3 SCD, DBG
LeBlond 23"x16' bed H.D. Screw Cutting Engine Lathe
Monarch 14"x8' 3 SCD, DBG
Monarch 16"x6'—16"x8' GH, MD
Reed Prentice 10"x8' GH, MD
Sebastian 16"x8' 4 SCD
Lodge & Shipley 16"x6'—16"x8' Selective GH, MD
Lodge & Shipley 16"x8'—18"x10' Selective GH, MD
Lodge & Shipley 36"x26' Patent Head Lathe, SCEL
Lodge & Shipley 18"x8'—18"x10' 3 SCD, DBG
Schumacher & Boye Screw Cutting Engine Lathe, 36"x24'

Sebastian 20"x8' GH, MD Very Late Type
American 24"x12', 2 speed GH, SCEL
American 24"x12', 8 speed GH, SCEL
American 24"x16', GH, SCEL, MD
Ohio 20" Bank Geared 4 SCD
American 20"x26' GH, SCEL, MD
Lodge & Shipley 24"x14', SCEL, 3 SCD, Dbu
LeBlond 23"x12' HD, QC, SPD, SCEL
LeBlond 23"x16', HD, 3 SCD, SCEL
Niles Timesaver 36"x10' (First Class Cond.)
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Gleason 6" Bevel Gear Generator SPD
Gleason 15" Spiral Bevel Gear Generator
Barber Colman Model 5 for Precision Gears
Fellows #615 Helical Spur Gears MD
Fellows #6 Cuts internal & external
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Gould & Eberhardt 18 N Gear Hobber, MD
Brown & Sharpe 26", 39", 48" and 60", SPD
Cross, #1 Gear Tooth Rounder

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Landis 10"x24" Type C Hyd. Univ., Latest
Landis 12"x72" Plain Cyl., M.D.
Landis 16"x72" Plain Cyl. Self Contained, MD
Landis 20"x220" Plain Cyl. Self Contained, MD
Landis Chaser Grinder, Model Y MD
Norton 10"x24" Type BA Plain Cyl. M.D.
Norton 16"x24" Type BA Plain Cyl. MD
Cincinnati 12"x48" Plain Cyl., MD
Brown & Sharpe #2 Univ., Belt Drive
Heald 72A3 Internal, Complete, MD
ExCello 31L Precision Thread MD
Rivett 104-2, Internal MD
Cincinnati No. 3 Centerless
Gardner #120 A SI Opposed Wheel Grinder Latest type
Gardner #124-53 Horiz. Disc Grinder MD
Pratt & Whitney 10" Spiral Gear, 2 Wheel type
Thompson 6"x16", 6"x24" Type F Hyd. Surface
Norton 6"x18" Surface Grinder, MD

LATHES—TURRET

Gisholt #3 Univ. Ram Type, New 1943
Gisholt, #3L, Saddle Type, Hardened Way, MD
Warner & Swasey #2A Hollow Hex
Warner & Swasey, #3 Univ. Late type
Warner & Swasey #3A Univ. Timken Bearing, MD
Jones & Lamson 3½"x32" Flat Turret, MD
Gisholt, #2L, Univ. New 1943

SHAPERS & SLOTTERS

Smith Mills 15" single pulley drive GB
Gould & Eberhardt 16", 20", 24" V ram, Cone drive BG
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Cincinnati 18" 24" Bank Geared, Cone Drive

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Cincinnati Machinery Co., Inc.
219 East Second Street
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2½" Acme Gridley model RA6, serial No. 84,496, new in 1943.

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10 ton, 72" stroke Colonial Model HAS-10-72 with outer support. New in 1942.

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10"x72" Colonial, new in 1943. Model CS1-72 for both round and flat broaches.

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16 spindle No. 2BL Natco hydraulic. 16"x 24" drilling area. Has 30" dia. automatically indexing head. New in 1942.

DRILL, MULTIPLE

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DRILL, SENSITIVE

24" Foote Burt No. 2 six spindle with two spindles back geared. Serial No. 14379, new in 1942.

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6"x18", No. 10 Brown & Sharpe "Electric Hydraulic" new 1940 & 1941. Three have spindle oscillation.

GRINDERS, CYLINDRICAL

10"x36" & 23"x36" Norton type C hydraulic with hydraulic in feed, also longitudinal travel. New 1942.

GRINDER, DISC

53", No. 372 Besly horizontal disc with 20 HP vertical motor drive. New in 1942.

GRINDER, INTERNAL

Nos. 16A16, 16CP16, 18-28, 16-38 & 24-36 Bryant. New from 1941 to 1943.

GRINDER, SURFACE

24", No. 25A Heald rotary, hydraulic feed. Serial No. 16051, new in 1942.

GRINDER, SURFACE

14"x60" Mattison hydraulic with 14⅛"x 60" magnetic chuck. New in 1939.

GRINDERS, THREAD

Nos. 33 & 35 Excello. New 1942 & 1943.

HONING MACHINE

No. 307 "Barnesdril" hydraulic, 25" stroke. Serial No. 3536, new in 1942.

LATHES

8"x15", No. 8 and 12"x20", No. 12 Sundstrand automatic stub with front & rear carriages and tailstock. New in 1942.

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Nos. 3 & 4 Gisholt universal with bar feed, automatic chuck, etc. 1942 & 1943 tools.

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Two No. 2 Cincinnati vertical, medium speed dial type with 16" rotary tables. New in 1942.

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PRACTICALLY NEW

Liberty 48"x48"x16' double housing Planer, mfg. in 1942, serial No. 531-6. With four heads (two rail heads and two side heads). Complete with DC motor Drive, Generator, etc. Excellent Condition.

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3'-9" American "Hole Wizard" Radial
10"x48" Norton "C" Plain Grinder
#76-A Heald Internal Grinder
Model 2-H Micromatic Hydrohoner
#3H Milwaukee Plain Miller
#3MS Cincinnati Miller
8"x48" J&L Thread Grinder

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Boring Mills, 24"-36"-42"-52"
Drills, Radial 3'-4'-5'-6' Cin.-Bick.
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Millers, Plain No. 2 K and T, No. 4 Cin.
Millers, Vertical No. 3 and No. 4 Cin.
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Shaper, 36" Morton Draw Cut.
Shears, 42"-60"-72"-132"

West Penn Machinery Company
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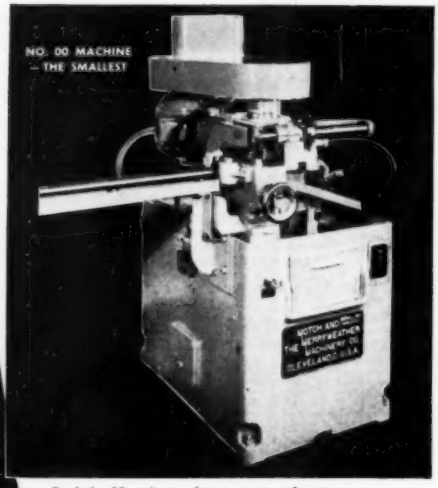

At left: No. 4 machine, in production at the Crucible Steel Co., Syracuse, N. Y.

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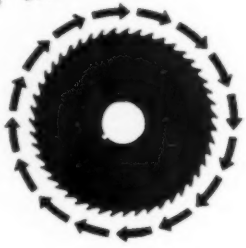
USE THE MOTCH & MERRYWEATHER Triple-Chip METHOD OF CIRCULAR SAWING



- CONTINUOUS POWER UTILIZATION.
- CONTINUOUS CUTTING—NO TIME LOST IN BRINGING TOOL BACK TO CUTTING POSITION.
- TOOTH FORM DEFIES BREAKAGE.
- MINIMUM WASTE; ENDS SQUARE, BURRLESS, ACCURATE TO LENGTH WITH MILLED FINISH.

M. & M. SAW BLADES MAKE CUTTING AND MILLING OPERATIONS MORE PROFITABLE

For larger stock, segmental blades in diameters from 11" to 70"; for smaller stock, solid blades in diameters from 3" to 18". The efficient and well known Triple-Chip grind may be had in both types.

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No. 00—for ferrous and non-ferrous stock up to 2" round or square.
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No. 2—for ferrous and non-ferrous stock up to 6" round or square.
No. 3—for ferrous and non-ferrous stock up to 10" round or 9" square.
No. 4—for ferrous and non-ferrous stock up to 16½" round or 15" square.

Special machines to meet your requirements.

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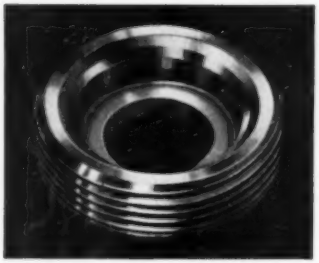

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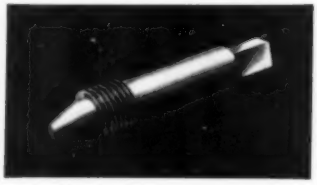

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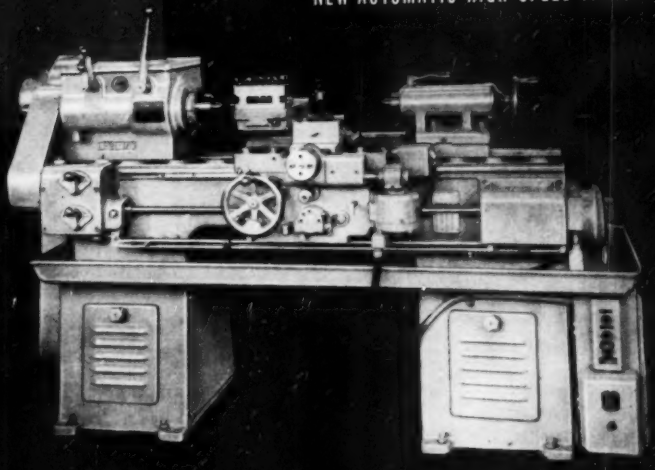

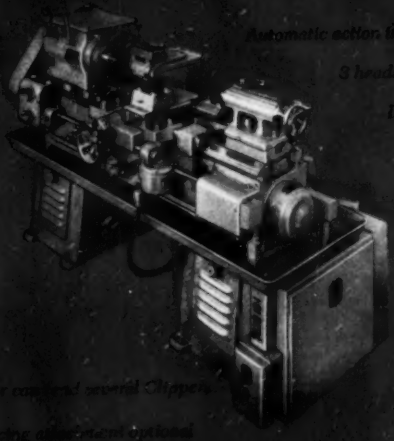

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